OWMC

ONTARIO WASTE MANAGEMENT CORPORATION
FACILITIES DEVELOPMENT PROCESS

PHASE 1 REPORT

Assembly and Analysis of Primary Information
on Engineering, Environmental and Planning Issues

September 1982

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Each Chapter is summarized at its end.

1. INTRODUCTION

PURPOSE OF THIS REPORT

This report summarizes the key information and issues contained in studies recently completed for the Ontario Waste Management Corporation (OWMC). The completion of these studies marks the end of the first phase of OWMC's planning program - called the Facilities Development Process - which is designed to develop proposals for a province-wide industrial waste management system. While each study is different in scope and subject, they all stem from the need to examine several basic issues: what are the types, quantities and sources of liquid industrial waste and hazardous waste generated in Ontario; how can this material be safely and efficiently treated and disposed of; what are the key issues that must be addressed in choosing the treatment and disposal facilities required; and where should they be located?

It is not the purpose of this report to identify specific sites. They cannot be identified until the results of these studies have been evaluated in more detail. This report is designed to link together the key findings of the studies (Chapters 2 to 4), to define their relevance to possible system options (Chapter 5) and to describe the issues that must now be addressed (Chapter 6). The Phase One study reports are available and can be obtained by contacting Michael Scott, Director of Communications of the Ontario Waste Management Corporation, 60 Bloor Street West, Suite 707, Toronto, Ontario, M4W 3B8, 416-963-1162 (or toll free number 1-800-268-1179).

BACKGROUND INFORMATION

OWMC's Mandate

As a provincial crown agency, OWMC has, as its mandate, the implementation of a province-wide program for the management of liquid industrial waste and hazardous waste. This program will include building and managing facilities for the treatment and disposal of wastes and developing programs to assist in the reduction and recycling of these wastes.

Three questions arise:

- What is included in liquid industrial waste and hazardous waste?
- What would be entailed in a province-wide waste management program?
- How can an appropriate waste management system be developed for Ontario?

Let us consider those questions.

Liquid industrial waste and hazardous waste

What is "liquid industrial waste and hazardous waste"? These wastes are not specified by law in Ontario, although the Ministry of the Environment does have specific regulations - currently under review - for the transportation, treatment and disposal of certain types of industrial wastes. OWMC, therefore, has had to undertake its own classification and quantification of Ontario wastes to determine and estimate those for which its facilities must be developed.

OWMC has examined and compared how seven other jurisdictions define and classify waste. From this comparison of other classification systems, OWMC adopted a classification of these wastes that provides the scope and detail it feels is required to help determine the size and nature of its system.

For the purpose of this phase of its work, OWMC has defined liquid industrial waste and hazardous waste as "waste that requires special treatment", that is, waste that cannot be adequately dealt with by the conventional methods used by existing public facilities, such as municipal sewage treatment plants, municipal incinerators and municipal landfills.

In this report, therefore, the following terms are used synonymously: "liquid industrial waste and hazardous waste," "special waste" and "waste requiring special treatment."

A province-wide waste management program

One of the first tasks of the Corporation was to examine the possibility of constructing a treatment and disposal facility on government-owned property at South Cayuga, in the Regional Municipality of Haldimand-Norfolk. Preliminary

hydrogeological and geological studies of the site conducted for the Corporation revealed that it had several shortcomings, and the Board of Directors of OWMC voted unanimously to reject the site in November 1981. The selection of acceptable sites then became part of the planning of a comprehensive province-wide waste management system of which a land disposal facility would be only one component - preferably a small one. The other main components of a waste management system include the development of waste abatement and recycling procedures and technologies and collection and treatment facilities. OWMC's activities will encompass all these aspects of waste management.

The reduction and recycling of wastes has become a commercial practice already in some cases, though there is potential for expansion. OWMC recognizes the need to find practical ways to encourage the private sector to undertake further reduction of the waste streams requiring treatment and disposal, because no long-term waste managment program can ignore this necessity. Moreover, OWMC has been repeatedly urged by the public not to put all its resources and attention into simply building and managing facilities. In August, therefore, OWMC commissioned the Ontario Research Foundation to conduct a Waste Reduction Opportunities Study, which will identify the specific role OWMC could take in this area.

The nature and size of the collection and treatment facilities must also reflect OWMC's best judgement as to the types and volumes of wastes that will require such facilities in the foreseeable future. To make this decision OWMC will seek assistance from waste generators, handlers, government and municipal officials and the public during September and October in the next phase of its work. The definition of liquid industrial waste and hazardous waste used in this report and the estimates of waste quantities presented here are, thus, just a first step. The importance of further refining these definitions and estimates cannot be overemphasized.

The facilities development process

The results of the major studies outlined in this report are all part of the Facilities Development Process illustrated in Figure 1. The purpose of this process is to define possible options, to schedule and conduct the studies necessary to evaluate these options, to select a preferred option - in terms of the type and location(s) - of the necessary treatment and disposal facilities, and to prepare a detailed

proposal. This proposal will then be submitted to an independent Hearing Panel which was appointed by The Ontario Government in 1981; following public hearings, the Hearing Panel will submit a report to the government on the safety and suitability of the Corporation's proposals.

Public consultations are an important part of this process. During Phase One, a two-day seminar was held with representatives of industry, citizens groups and professional organizations to assess the Corporation's approach to the development and execution of a liquid industrial waste and hazardous waste management program for Ontario. More than one thousand organizations and individuals were contacted by mail. In addition, six seminars were conducted jointly with the Association of Municipalities of Ontario, covering all of southern Ontario, at which elected officials and municipal administrators discussed with OWMC the Facilities Development Process in terms of provincial and regional needs.

Separate meetings were held with provincial organizations, including the Ontario Federation of Agriculture and the Provincial Council of Women of Ontario, and with thirty-four broad interest groups, including industry, labour and citizens' organizations. In addition, seventy meetings were held with individual groups and organizations, making a total of 300 meetings in all.

The purpose of those contacts was to inform the various segments of the public having a direct interest in and concern about the management of industrial waste on the extent and nature of the problem, the role of OWMC, the planning process currently underway and the opportunities for participation. Assurance was given that there would be "no surprises" in OWMC's dealings with the public and that concerned groups would be consulted before key decisions affecting them are made.

WHAT THIS REPORT COVERS

This report summarizes the Phase One studies and outlines, in general terms, the system options they suggest. It also outlines the issues and questions that OWMC must now address, in consultation with the public, during the evaluation stage (Phase Two) of the Facilities Development Process.

The Phase One studies began the examination of the following topics:

- the types, quantities and sources of liquid industrial waste and hazardous waste generated in Ontario;
- possible reduction, treatment and disposal techniques for each type of waste;
- the major geological/hydrogeological features of southern Ontario;
- the system options for a liquid industrial waste and hazardous waste management system, and the key factors in evaluating them;
- other factors affecting the size and location of facilities, such as land use, engineering infrastructure, archaeology, climatology, transportation networks, surface water characteristics and environmentally sensitive areas.

OWMC has made several policy decisions that will govern the evaluation process:

First, the Corporation is committed to finding ways to reduce and recycle wastes, and specific steps are being taken to ensure that this key corporate goal is implemented.

Second, OWMC is committed to the principle that no hazardous waste will be placed untreated in a secure landfill, and will only utilize technologies that have proven successful. These technologies do exist - in Europe, Japan and the USA - as the studies and recent tours by OWMC officials have confirmed.

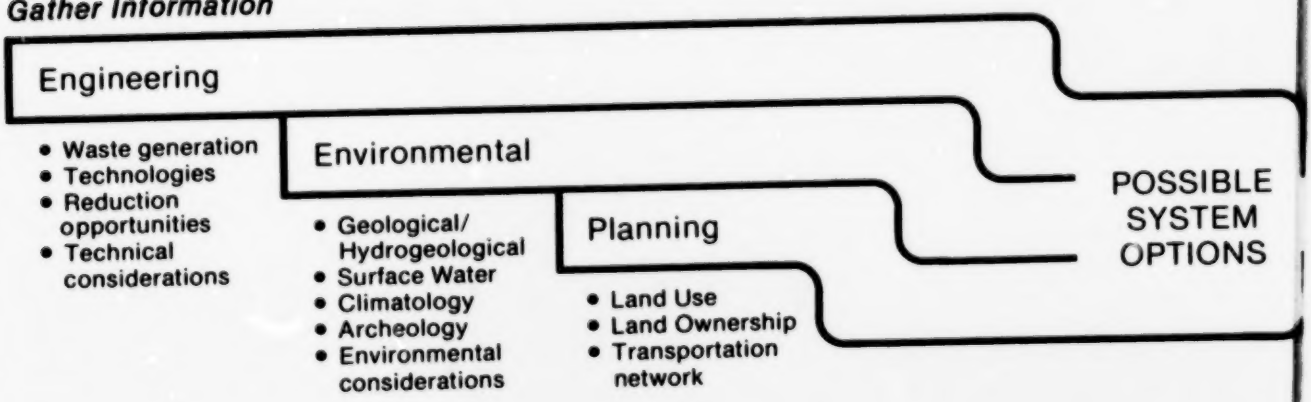
Third, OWMC is committed to consulting with the public and will provide, through the Hearing Panel, financial assistance to eligible participants in the public hearings.

Facil

Phase: 1

Process Initiation

Gather Information



Facilities Development Process

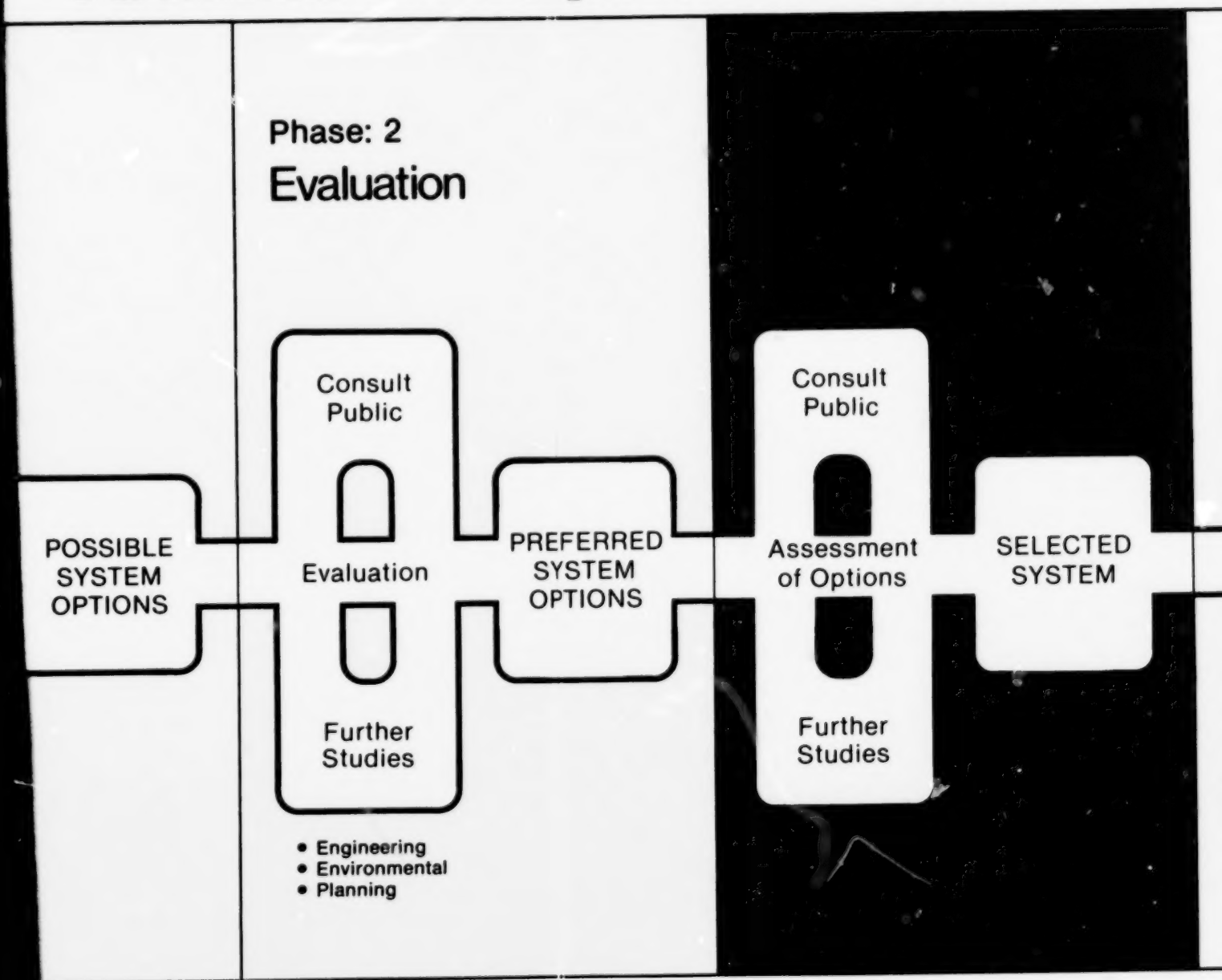
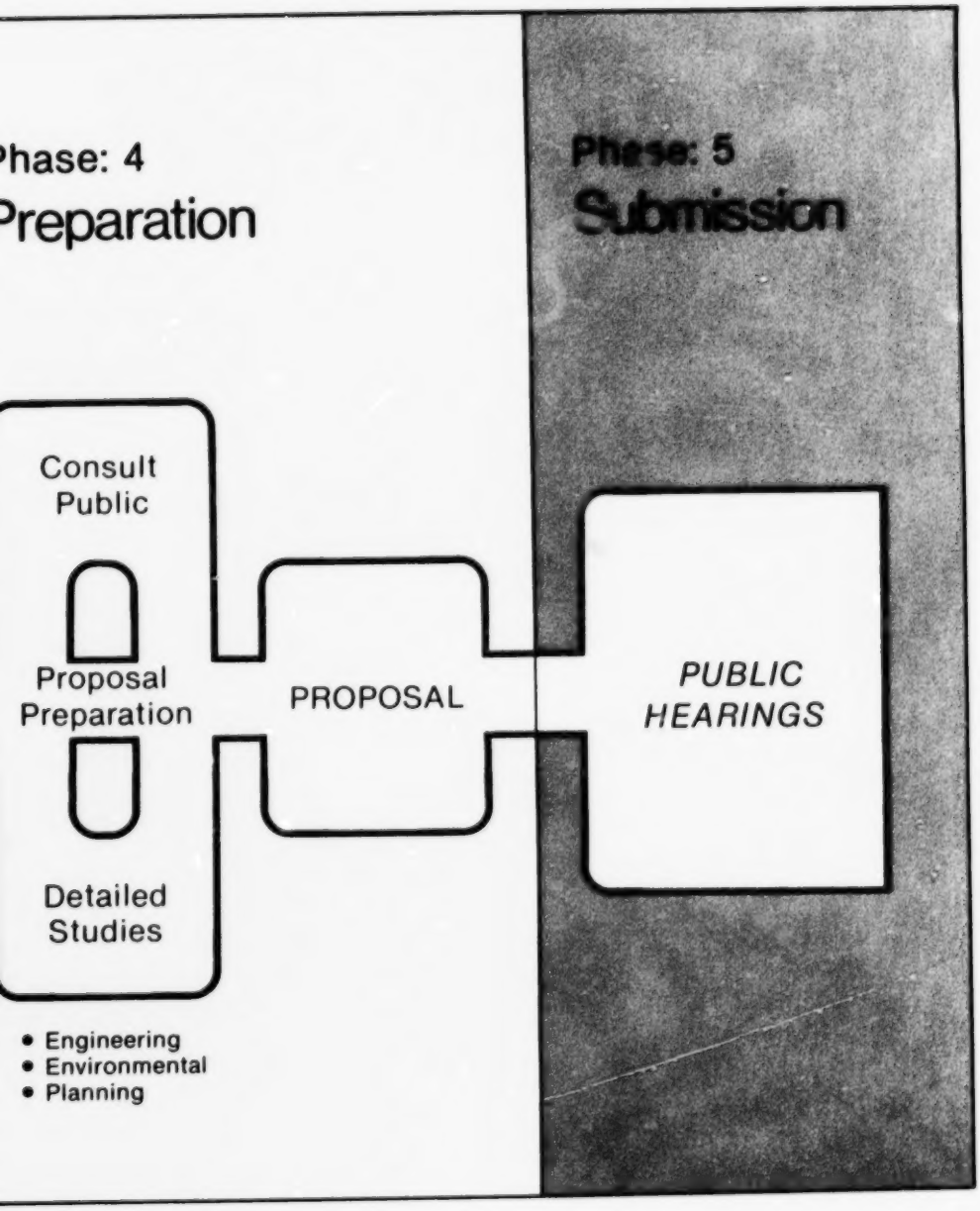


FIGURE 1


Phase: 4
Preparation
Phase: 5
Submission
Consult Public
Proposal Preparation
PROPOSAL
PUBLIC HEARINGS
Detailed Studies
• Engineering
• Environmental
• Planning

2. THE NATURE OF ONTARIO'S LIQUID INDUSTRIAL WASTE AND HAZARDOUS WASTE

INTRODUCTION

One of the earliest and most important tasks of OWMC was to develop an inventory of the types, quantities and sources of liquid industrial waste and hazardous waste generated in Ontario and to identify facilities now receiving, treating and disposing of this material. Essentially, OWMC needs to know how much of this waste is generated in Ontario, the kinds and quantities, the sources, and how these wastes are currently being handled.

Several hazardous waste studies have been undertaken in Ontario, but none proved satisfactory for OWMC's purposes. They were either not comprehensive - did not cover all of Ontario or did not include all industries generating wastes - or not confirmed by direct surveys of key waste generators to verify estimates. OWMC therefore commissioned its own Waste Quantities Study designed to be comprehensive and verified by survey.

The key tasks in the study were to determine the wastes that should be included under the definition of "liquid industrial waste and hazardous waste," the classification system that should be selected or developed to list these wastes, and finally the method that should be used to estimate the quantities each industry generated in Ontario in 1981.

SPECIFYING LIQUID INDUSTRIAL AND HAZARDOUS WASTE

In assessing what wastes to include as its target, the Corporation's Waste Quantities Study has carefully examined definitions used in other jurisdictions and sought the opinion of experts in the field. OWMC's current definitions will probably be modified over time as new waste substances are produced and additional research information becomes available. OWMC will be seeking further advice from all interested parties on the waste quantities estimates.

As noted earlier, the Waste Quantities Study defines liquid industrial waste and hazardous waste as those industrial wastes that cannot be properly dealt with

in a conventional manner, by existing public facilities such as municipal sewage treatment plants, municipal incinerators and municipal landfills. Such wastes require special treatment and disposal of the kind OWMC will provide.

In order to establish an estimate of the kinds and amount of Ontario industrial waste requiring special treatment, without neglecting any type of waste, a comprehensive approach was adopted (Figure 2). This approach arrives at a specification of special waste by starting from all wastes of every kind and systematically excluding those types of waste that for various reasons seem not to fit the definition of industrial waste requiring special treatment. If, on further consideration, some wastes thereby set aside should appear to deserve inclusion, the procedures established in the Waste Quantities Study make that inclusion possible. The explicit intention of the Waste Quantities Study was to establish an estimate capable of further refinement, if necessary, and clear and precise enough to allow questions of facility size and design to be discussed in detail. Starting from total waste, then, the exclusions proposed in the Waste Quantities Study are as follows:

- exclude non-industrial waste, except institutional (e.g. hospital) and commercial (e.g. dry-cleaning) on the grounds that conventional treatment is adequate and it lies beyond OWMC's mandate. Therefore, municipal solid waste and domestic sewage is excluded, to arrive at total industrial waste;
- exclude industrial waste not requiring treatment and disposal because it is non-hazardous, is not subject to treatment and disposal or receives regulated disposal at the site, such as dredgings, mining overburden and slurry, and forestry cuttings, to arrive at total industrial waste requiring treatment and disposal;
- exclude radioactive waste which at present is a federal responsibility, to arrive at total industrial waste requiring treatment and disposal.

The quantities of each of the wastes proposed for exclusion above were not estimated. Attention was concentrated instead on the quantity of industrial waste remaining under consideration after these exclusions.

A review of waste classification systems was undertaken to see which one best captured industrial waste requiring special treatment and disposal. Of the

seven waste classification systems reviewed, the one developed at the University of California at Davis (UCD) was judged to be the most suitable method of classifying that waste quantity (Appendices A and B). The UCD waste classification system is considerably more specific than most other systems, allows the physical and chemical properties of a waste stream to be identified and compared, is compatible with many other North American inventories, and allows for a significant degree of detail within each category.

When the UCD classifications were applied it became apparent that many of them represented kinds of waste that did not need special treatment. These wastes could be adequately dealt with by the conventional methods of existing public facilities. Therefore, starting from total industrial non-radioactive waste requiring treatment and disposal one further exclusion was proposed:

- exclude all UCD classes of waste for which conventional methods of treatment and disposal, as defined above, would be adequate, to arrive at total industrial waste requiring special treatment and disposal, that is, "special waste".

The waste types proposed for exclusion in this step also were not estimated as to quantity; only the remaining classes, 79 in number, which constitute "liquid industrial waste and hazardous waste", or "special waste", or "industrial waste requiring special treatment", have quantitative estimates (Appendix B).

STUDY METHOD

The next task in the study was the selection of a method to estimate the types and quantities of the specified wastes. A variety of techniques have been used (in other studies and jurisdictions) to estimate waste generation, and they have been based on the following:

- permit or manifest system records;
- reported disposal data;
- data from industry surveys based on visits or questionnaires;
- formulas that estimate the amount of waste generated within each industrial sector.

The study team examined each of these methods in detail. There are shortcomings inherent in basing estimates on recorded data such as permit, manifest or disposal records - not all data bases may be complete, and disposal data, for instance, do not exist in Ontario.

The method selected for the Waste Quantities Study combines the formula approach, which uses a model to estimate the amount of waste generated, with a survey of key waste generators to verify or alter the estimates. The model assumes that the number of production employees in a plant is a valid indicator of the quantity of output and of waste generated (data on output are not available as a basis for estimating waste generation). Briefly, the method consists of the following basic steps:

A) A waste classification system is selected categorizing all the waste being considered.

B) Data from previous studies in other jurisdictions are analysed to produce "generation factors" showing the amount of each type of waste generated per production employee in each industry.

C) The number of production employees per industry is estimated using the most accurate sources available.

D) An interview survey of a representative sample of generators within key industries is conducted to verify waste generation rates and/or amend them. Eighteen industrial sectors representing major waste generators were selected, and about 100 firms in these industries were chosen for interviews, based on their size, diversity of product line and geographic distribution in Ontario.

THE ESTIMATED QUANTITIES GENERATED

The resulting estimates of quantities of industrial waste requiring special treatment generated in Ontario in 1981 are shown in Table 1 in which the UCD waste categories have been grouped into fourteen general waste types. There are several key points that must be stressed in examining these estimates. First, they are based, as any such estimates would have to be, on many specific judgements of what wastes fall within OWMC's mandate; those judgements are in OWMC's opinion reasonable first approximations, and OWMC will be seeking reaction to them in

September and October. Second, the estimated total does not represent the amount of waste likely to arrive at future OWMC facilities. The proportion of the total that eventually will be handled by OWMC will be the result of many factors, particularly the prices charged for treatment and disposal and the Ministry of the Environment's regulations in place at that time. Moreover, the estimated total does not represent an amount of waste being inadequately managed at present. The question of current methods of treatment and disposal is discussed in Chapter 3. The estimated total simply represents the total amount of waste generated by Ontario industry in 1981 that could have been adequately dealt with only by recovery and reuse or by treatment and disposal using technologies of the kinds discussed in this report.

The quantity estimates contain the following significant findings:

- A total of 1.5 million tonnes of waste requiring special treatment are estimated to have been generated in Ontario in 1981. (To convert to Imperial gallons, assume that 220 Imperial gallons equal 1 tonne.)
- Three categories contain most of the total: approximately 39% consists of heavy metal solutions and residuals, about 17% of inorganic sludges and residuals and a further 15% consists of organic and oily residuals. Heavy metal solutions and residuals include plating or etching rinses and sludges from the treatment of solutions containing metals. Inorganic sludges and residuals are largely ash and chemically inert residues. Organic and oily residual wastes include residuals from the production of leaded and unleaded gasoline and organics and food waste oils.
- 58% of the estimated total is in liquid form, 17% is in the form of sludge and 25% is in solid form. Liquids have the potential to be reduced substantially in volume by pre-treatment before being sent to a waste treatment facility.
- Three-quarters of Ontario special waste is inorganic, one-quarter is organic.

The special waste generated per production employee per year in Ontario is 1.8 tonnes on average. This number is in the same order as estimates for United States jurisdictions with similar industrial mixes such as Ohio, California and New Jersey.

There are no comprehensive waste statistics in Ontario, and only a small portion of industrial waste is on the public record, such as in the provincial Waybill system (discussed below). In the absence of comprehensive statistics the waste quantities analysis was based on the fact that an industry of a given size and output with a given technology must produce certain amounts of certain kinds of waste, whether or not any record is kept of them. This estimate is somewhat higher than previous ones based on the limited statistics that are available. Until now most of this waste has not been identified and quantified. When account is taken of the limitations of the information gathered for previous estimates, however, they tend to confirm the new estimates.

INDUSTRY SOURCES

Significant industry generators of waste requiring special treatment are shown in Figure 3. Approximately 52% of these wastes are generated by the primary metal industries, including blast furnaces and rolling mills, steel wire, bar and pipe manufacturers, malleable iron foundries, and smelters and refiners of non-ferrous metals such as copper, lead, zinc and aluminum.

A further 10% of the wastes are generated by the chemical industry, including industrial gases, plastic materials, synthetic resins, synthetic organic fibres, soaps and detergents, paints and varnishes, and pesticides and agricultural chemicals.

Other industries generating waste requiring special treatment are those fabricating metal products, non-electrical machinery, paper products and transportation equipment.

GEOGRAPHIC SOURCES

Figure 4 shows in very general terms where the 1.5 million tonnes of special waste are generated in various areas around Ontario. Nearly 90% is generated in southern parts of the province, with 70% coming from south central Ontario, most of it concentrated in the highly industrialized area around Lake Ontario from Oshawa to Niagara Falls. Outside the south central region the largest contribution is from southwestern Ontario (14%), which includes London, Sarnia, Chatham, and Windsor. In northern Ontario most of the special waste is generated in the industrial region centred on Sault Ste Marie (6%).

HAZARDS OF SPECIAL WASTE

The components of special waste are not all equally hazardous in the concentrations in which they are normally generated, but all represent some degree of danger if not properly treated and disposed of and must be prevented from entering aquatic systems or food chains. For example, PCB, pesticide or cyanide wastes in themselves clearly represent a greater degree of immediate danger than oily water. The quantity of a waste is thus not a direct indicator of the danger it represents. However, the Phase One studies do not try to measure or compare the hazards represented by the many types of special waste. Scientific definitions of hazard, such as toxicity, pathogenicity, flammability, explosiveness or corrosivity, as applied to pure substances in laboratory conditions, do not necessarily encompass the real dangers involved.

Even within a specified context the degree of hazard represented by a type of waste depends in large part on the concentration encountered and the circumstances of the encounter. For instance, mercury in water where it can be absorbed into living tissue is much more dangerous than mercury immobilized in a solid matrix. Because so many variables are involved in practical situations, special waste components have been defined by the fact that special treatment is required rather than by the probability and degree of hazard represented.

Nonetheless, all the components of special waste outlined in the Waste Quantities Study can be hazardous. Moreover, their gradual accumulation year after year, if allowed to occur, represents clear long-term dangers to human health and the natural environment. In short, any special waste that is left untreated or mixed with sewage or solid waste for conventional treatment in public facilities represents a variety of short-term and long-term dangers that can be avoided by the application of current advanced treatment and disposal technologies.

SPECIAL WASTE IN THE CONTEXT OF TOTAL WASTE (ESTIMATED)

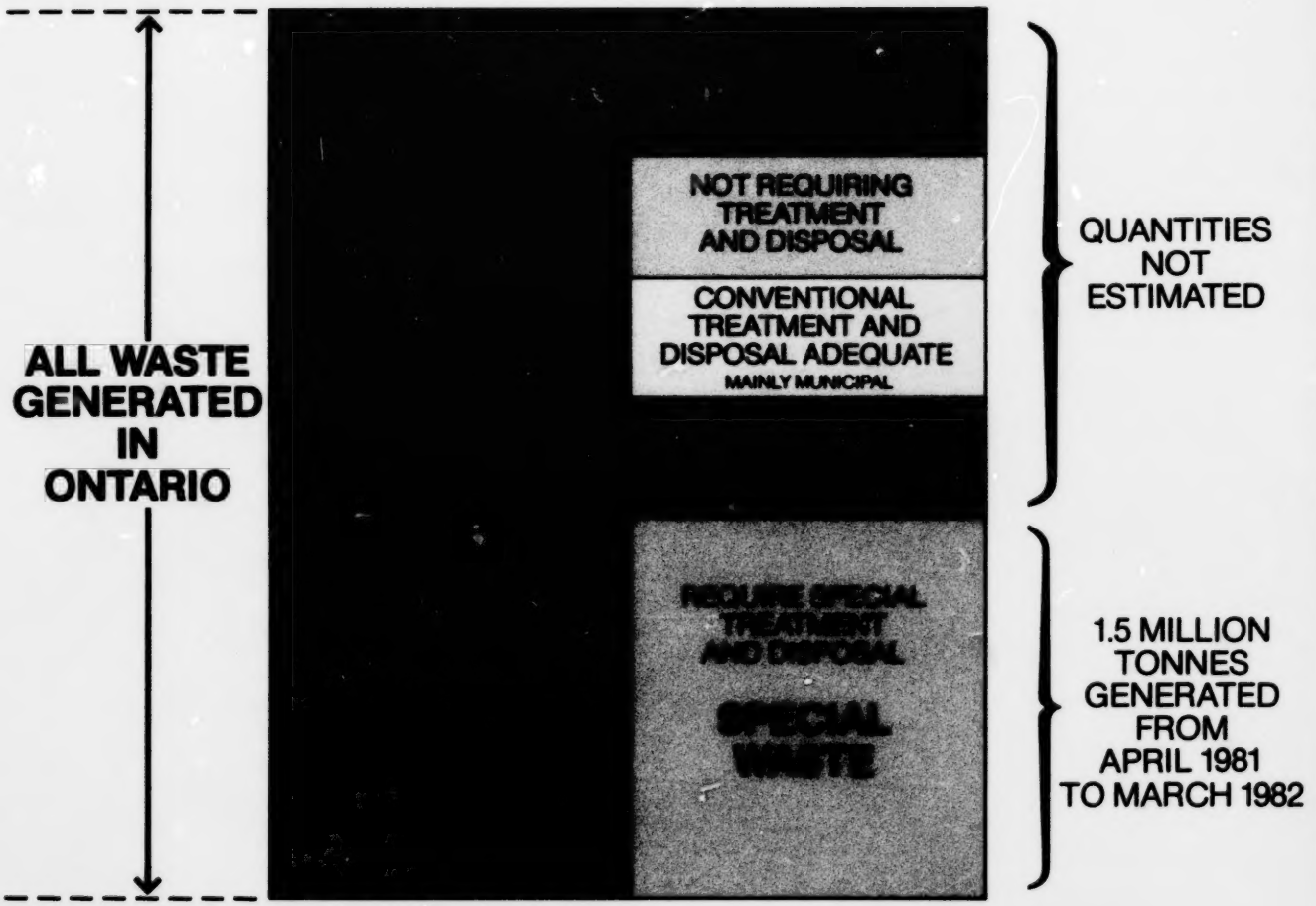

ALL WASTE GENERATED IN ONTARIO
NOT REQUIRING TREATMENT AND DISPOSAL
CONVENTIONAL TREATMENT AND DISPOSAL ADEQUATE
MAINLY MUNICIPAL
REQUIRE SPECIAL TREATMENT AND DISPOSAL
SPECIAL WASTE
QUANTITIES NOT ESTIMATED
1.5 MILLION TONNES GENERATED FROM APRIL 1981 TO MARCH 1982

FIGURE 2

TABLE 1

ESTIMATE OF WASTES GENERATED (1981)
BY WASTE CATEGORY AND PHYSICAL CHARACTERISTICS (TONNES)

WASTE CATEGORY	SOLID	LIQUID	SLUDGE	TOTAL	% OF TOTAL
Heavy metal solutions and residuals	-	514,700	59,600	574,300	(38.5%)
* 111, 112, 113, 121, 122, 123, 131, 132, 133, 141, 142, 143, 244, 251, 431, 433, 445, 523					
Inorganic sludges and residuals	192,400	-	54,400	246,800	(16.6%)
* 151, 165, 167, 417, 441, 443, 518					
Organic and oily residuals	17,300	169,400	34,700	221,400	(14.9%)
* 264, 282, 284, 285, 286, 288, 289, 447					
Miscellaneous chemicals and products	135,200	5,400	4,100	144,700	(9.7%)
* 145, 152, 243, 245, 416, 513					
Oil/water mixtures	-	69,000	-	69,000	(4.6%)
* 283					
Oils and greases	-	51,000	-	51,000	(3.4%)
* 281					
Paint and organic residuals	11,700	-	38,300	50,000	(3.4%)
* 254, 258, 262, 454, 455					
Organic sludges and still bottoms (no oil)	4,100	-	43,000	47,100	(3.2%)
* 247, 248, 252, 261, 263, 272, 446, 523, 529					
Solvents and organic solutions	-	42,100	-	42,100	(2.8%)
* 211, 212, 213, 214, 215, 216, 217, 221, 222, 223, 224					

TABLE 1 (CONTINUED)

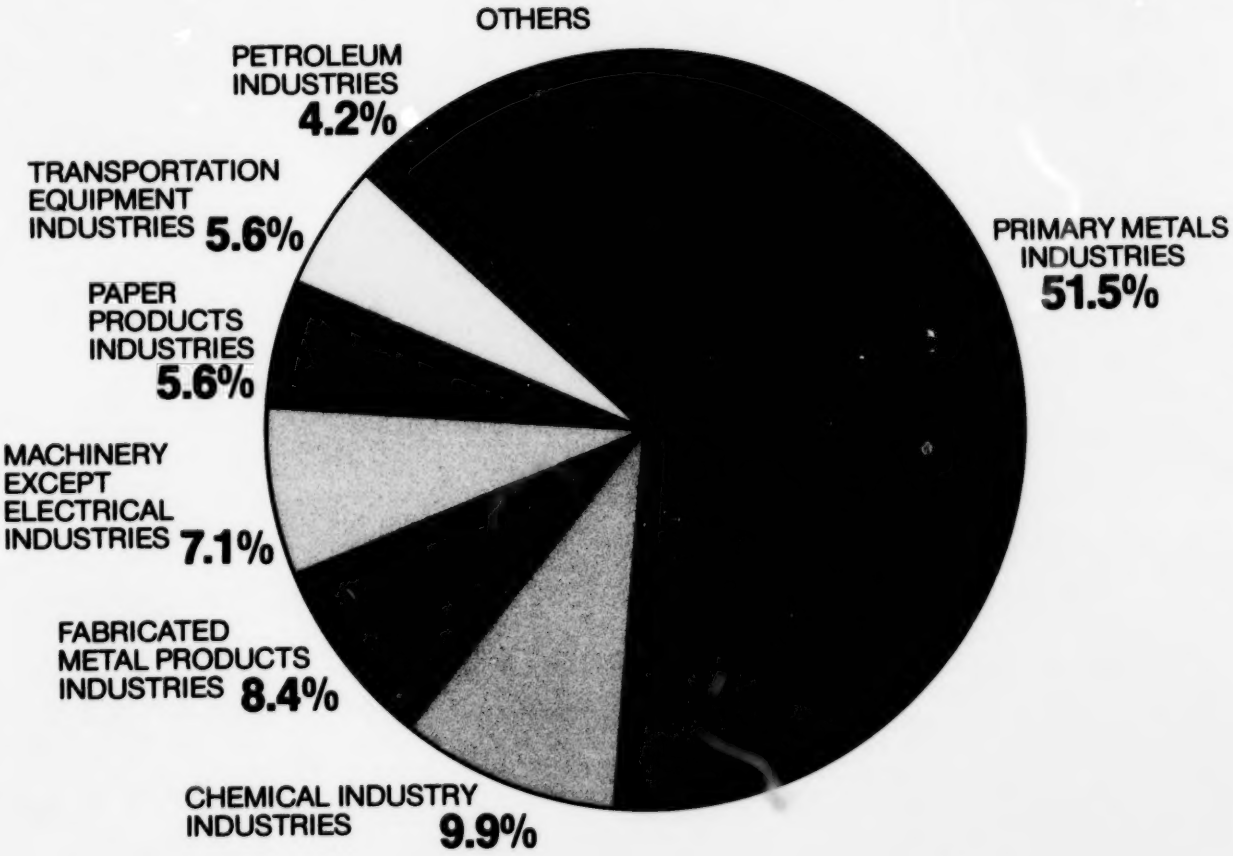
ESTIMATE OF WASTES GENERATED (1981)
BY WASTE CATEGORY AND PHYSICAL CHARACTERISTICS (TONNES)

WASTE CATEGORY	SOLID	LIQUID	SLUDGE	TOTAL	% OF TOTAL
Anion complexes	-	7,400	27,400	34,800	(2.3%)
* 146, 147, 444, 509					
Clean-up residuals	7,600			7,600	(0.5%)
* 512, 521, 528, 531					
Aqueous solutions with organics	-	700	-	700	(0.0%)
* 225, 226, 227, 228					
Pesticide and herbicide wastes	600	-	-	600	(0.0%)
* 241, 532					
PCB wastes	200	-	-	200	(0.0%)
* 242					
TOTAL	369,100	859,700	261,500	1,490,300	(100.0%)

*Note: Appendix A gives the UCD classifications for these numbers.

PRINCIPLE GENERATORS OF SPECIAL WASTE IN ONTARIO

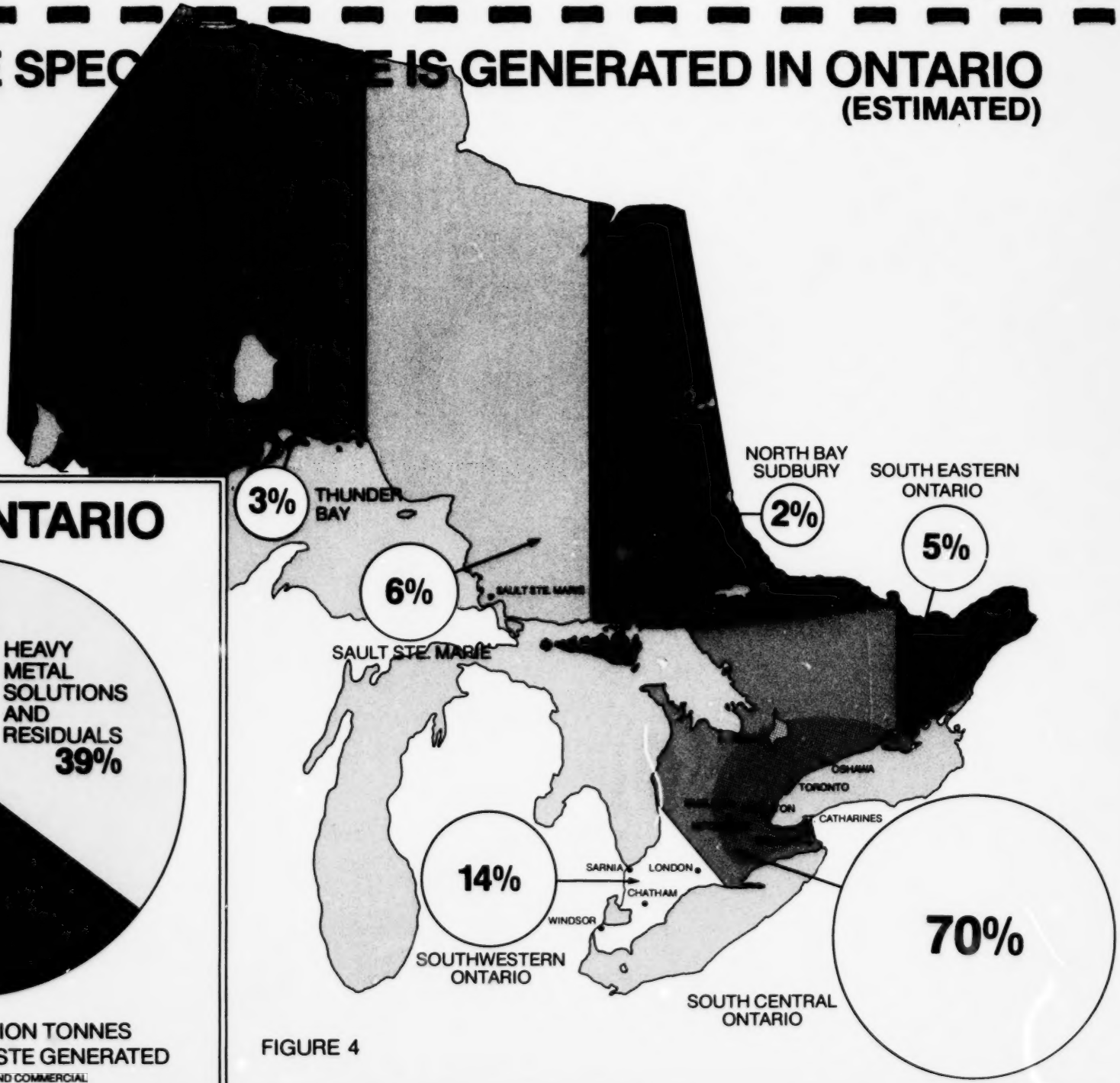
(ESTIMATED)



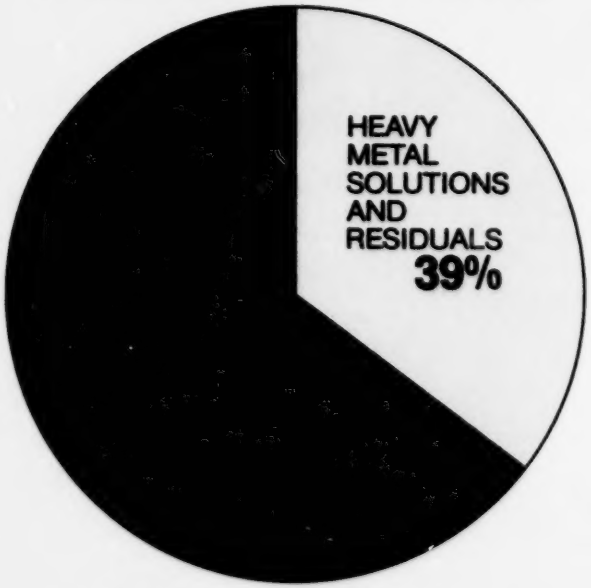
100% = 1.5 MILLION TONNES

FIGURE 3

WHERE SPEC E IS GENERATED IN ONTARIO
(ESTIMATED)



ALL OF ONTARIO



100% = 1.5 MILLION TONNES
TYPES OF SPECIAL WASTE GENERATED
*INCLUDES INSTITUTIONAL AND COMMERCIAL

FIGURE 4

SUMMARY

- OWMC has defined liquid industrial and hazardous wastes as those wastes that cannot be properly treated and disposed of by the conventional methods of existing public facilities, such as municipal sewage treatment plants, municipal incinerators and municipal landfills.

- The waste classification system adopted is based on that used by the University of California at Davis (UCD).

- The Waste Quantities Study conducted by OWMC's consultants uses a "by-production employee generation factor" for each type of waste in each specified industry over the period of a year, and the estimates were verified and refined by about 100 on-site interviews.

- An estimated 1.5 million tonnes of waste requiring special treatment were generated in Ontario in 1981.

- Approximately 58% of the estimated total is in liquid form.

- Three waste categories contain most of the total: approximately 39% is heavy metal solutions and residuals, 17% is inorganic sludges and residuals and a further 15% is organic and oily residual waste.

- Approximately 52% of the total is generated by the primary metal industries, and a further 10% by the chemicals industry.

- Nearly 90% of the total originates in southern parts of Ontario, and 70% is generated in south central Ontario - most of it in the highly industrialized area around the western end of Lake Ontario.

- Not all types of special waste are equally dangerous in the concentrations usually generated, but all of them represent at least long-term dangers to human health and the environment; some are dangerous in any quantities, and many could be very dangerous in an immediate sense if high concentrations occurred and were encountered in unguarded circumstances.

3. PRESENT TREATMENT AND DISPOSAL PRACTICES

This chapter considers the special waste generated in 1981: what methods of treatment and disposal are available and what proportions did, and did not, receive the special treatment they required.

METHODS

The current methods of waste treatment and disposal in Ontario are as follows:

- waste exchange,
- on or off-site waste storage,
- waste export,
- on-site or off-site recycling, reclamation and reuse,
- on-site or off-site treatment and disposal.

Waste exchange

Essentially, waste exchange involves transferring specific wastes to another industry that can utilize them in its production process. The Canadian Waste Materials Exchange, which provides such a service, publishes a bulletin listing waste streams available for exchange. This bulletin is issued six times a year and is sent to several thousand industries. It is estimated that less than 1% of special waste generated in Ontario is exchanged by this method.

On or off-site waste storage

Storage is used for wastes for which suitable treatment and disposal facilities are not yet available. Virtually all PCB wastes in Ontario, for example, which are created when equipment using PCBs is taken out of service, are stored on one of two licensed facilities: Ontario Hydro operates a facility strictly for its own wastes; Chemical Waste Management operates a licensed storage facility in Smithville for PCBs stored in drums.

Waste export

Some liquid industrial waste and hazardous waste is shipped out of the province for reuse, recycling, treatment and/or disposal. Most of the exports go to Quebec, New York State and Michigan.

Off-site recycling, reclamation and reuse

According to Waybill data more than twenty firms in Ontario receive shipments of liquid industrial wastes for recycling, reclamation or reuse. The wastes are principally oily water, organic solvents, chlorinated solvents, acids and waste oils.

Increasing amounts of waste solvents and oils are being reprocessed for reuse, primarily at off-site facilities. This is done on either a "toll basis", where waste from a particular firm is collected, reprocessed and returned for a fee, or on an "ownership" basis, where a reprocessor purchases the waste from a generator for reprocessing and sale to the generator and elsewhere.

Off-site treatment and disposal

Some special waste is transported to public or private treatment and disposal facilities. The facilities used include incinerators, public landfills, private landfills and sludge farms, and sewage treatment plants. Biological land farms are utilized by many industries generating wastes amenable to biological treatment, primarily waste oil.

On-site treatment and disposal

Significant quantities of special waste are treated, disposed of or recycled at on-site facilities, although the precise estimate is difficult to determine because complete data are not available.

Treated effluent is discharged to a surface water receiver, such as a river or lake, or to a sewer. The Ministry of the Environment is responsible for point-source discharges to surface water, while local and/or regional governments regulate discharges to sewers. Residuals from the on-site treatment of waste water require further treatment and are usually hauled to off-site treatment and disposal facilities.

On-site physical/chemical treatment practices are primarily neutralization and separation of solids from liquids. Acidic or basic wastes may be generated in large volumes by industry, and rather than being hauled off-site for treatment they are often neutralized and discharged to a sewer. Similarly, large volumes of aqueous waste with a solid content are partially dewatered on-site by industry, with the effluent being discharged to a sewer leaving a sludge for disposal.

Many hospitals in Ontario have on-site incinerators for the disposal of pathological wastes. Those hospitals without on-site incineration use frozen storage of wastes and then transport pathological waste to other facilities with incinerators.

THE CURRENT FATE OF SPECIAL WASTE

The present fate of the total quantity of special waste generated in Ontario cannot be determined from provincial statistics. Those data are based on only two sources of information: mandatory reports of liquid industrial wastes transported on public roads to licensed facilities (the "Waybill" records discussed below) and approvals obtained for discharge into sewers or surface water. Statistics based on these sources are not comprehensive.

The principal public source of information on present treatment and disposal practices is the Ministry of the Environment's Waybill system. It requires that certain types of liquid industrial wastes transported over public roads to licensed treatment and disposal facilities and for export from the province must be reported to the Ministry. (see Appendix B) The Waybill records have limitations for OWMC's purposes because the Waybill system was not designed to cover the following:

- most solid hazardous wastes and some liquid wastes;
- wastes disposed of on-site;
- wastes reclaimed, recovered or reused, on-site or off-site.

These limitations have meant that the Waybill system covers about one-seventh of the industrial waste in Ontario requiring special treatment. In a twelve-month period ending 31 March 1982, the system recorded about 228,000 tonnes of liquid industrial wastes disposed of in the following manner:

Incineration	31%
Public landfills	22
Private landfills and land farms	13
Sewage treatment plants	6
Reclaimers, reusers	17
Exported from Ontario	11
Total	100%

This information is useful, but since it covers only part of the special waste generated in the province OWMC has undertaken its own analysis. That analysis makes available a general view of what currently happens to the 1.5 million tonnes of special waste generated in the province. Figure 5 is based on interviews with waste generators, handlers and government and municipal disposal officials, other information gathered by the study team, and the evaluations of senior consultants familiar with industrial practices in North America generally and in Ontario particularly.

Of the 1.5 million tonnes of special waste generated in Ontario in 1981, it is estimated that 10% was reclaimed or recycled, 45% treated and stored or disposed of either at the source or off-site, 25% entered the sewer systems, 15% was mixed with municipal solid waste, and 5% simply vanished in ways not accounted for.

It must be emphasized that these are estimates only, and will be subjected to detailed examination with municipal and provincial waste management officials and with the generating industries. In particular, it will be important to examine the estimated 25% of special waste that enters the sewer systems.

OWMC's facilities must be designed particularly for those types and portions of special waste identified as inadequately handled at present, with the highest priority given to ensuring that all wastes judged to be very dangerous are properly dealt with. At the same time, OWMC's facilities, by their very existence, will also draw some part of the special waste adequately handled at present, to the extent that waste generators and waste managers find it advantageous to use them.

The waste that would come to OWMC in future circumstances could be influenced by three factors: the prices OWMC charges waste operators for the use of those facilities; more comprehensive and more strictly enforced regulation by government authorities; and increased concern by waste generators for the environment or for their future liability for current treatment and disposal practices. The fact that OWMC's facilities existed and could handle any waste stream would reinforce the non-economic incentives to use them.

SUMMARY

- Current methods of treatment and disposal have been identified as exchange, storage or export; recycling, reclamation and reuse; and treatment and disposal.

- Current sources of public information on treatment and disposal do not allow comprehensive statistics to be compiled; the Waybill records cover about one-seventh of special waste generated in Ontario.

- OWMC's commissioned research indicates that of the 1.5 million tonnes of special waste generated in Ontario in 1981, it is estimated that 10% was reclaimed or recycled, 45% treated and stored or disposed of either at the source or off-site, 25% entered the sewer systems, 15% mixed with municipal solid waste, and 5% simply vanished in ways not accounted for.

- OWMC's program will be aimed chiefly at the special waste which remains untreated, with highest priority given to any particularly dangerous waste concentrations; at the same time the existence of OWMC facilities will draw some portion of special waste already being adequately handled because of the economic advantages that may be offered.

PRESENT FATE OF SPECIAL WASTE IN ONTARIO
(ESTIMATED)

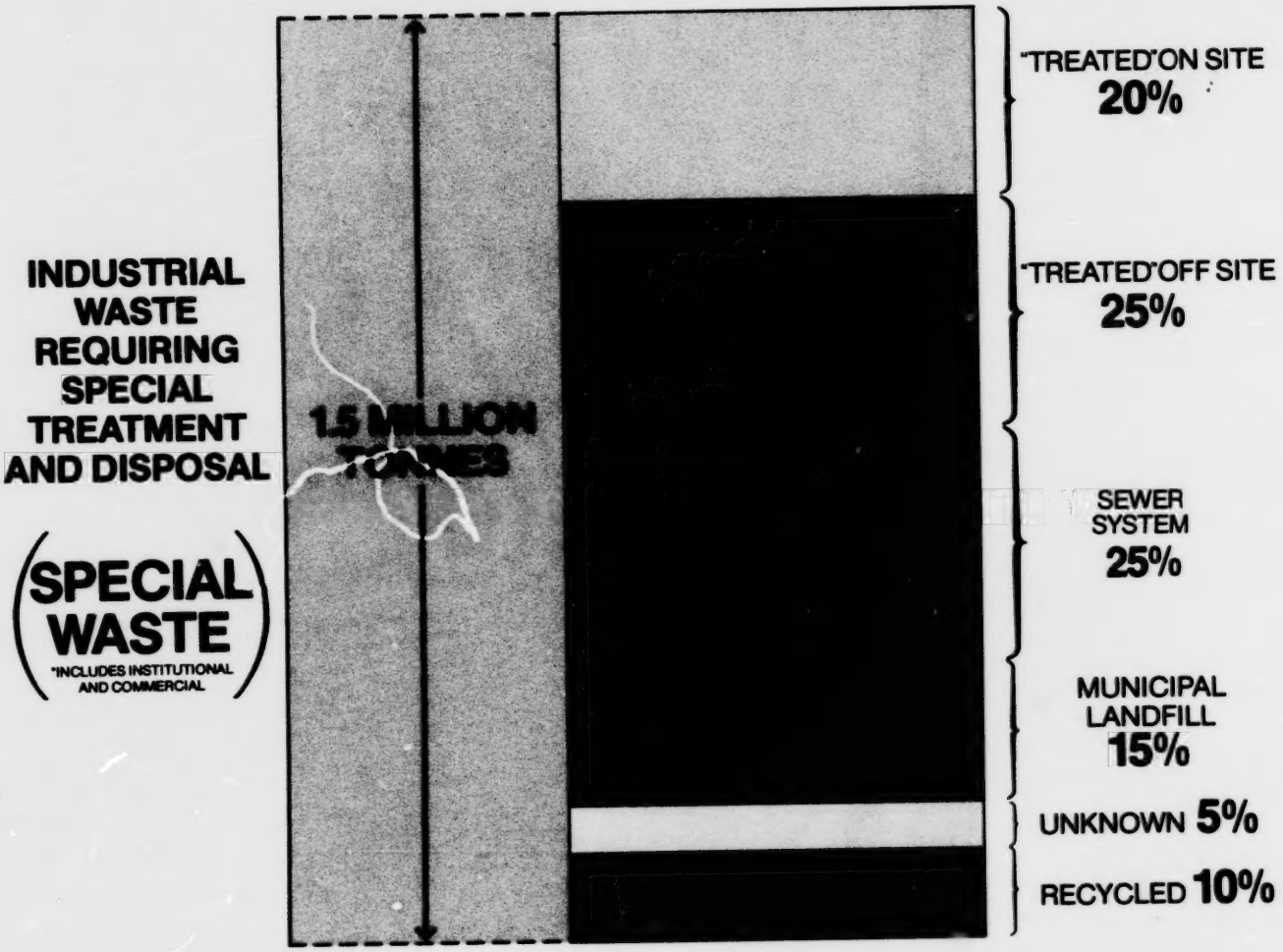


FIGURE 5

4. AVAILABLE TREATMENT AND DISPOSAL TECHNOLOGIES

BACKGROUND

In 1981 Ontario generated 1.5 million tonnes of a wide range of wastes requiring special treatment based on the survey results outlined in Chapter 3. What forms of special treatment exist that can be applied to them? In some cases there are opportunities for waste abatement, reduction, reuse or recycling, either on the generators' premises or in privately owned recycling facilities, and there are numerous processes being used internationally which could be utilized in Ontario. Even with such abatement and recycling practices, wastes will still be generated that require special treatment and disposal. The treatment processes and disposal practices in other countries can provide important information. OWMC therefore commissioned a study and evaluation of technologies used in Canada, the United States, Europe and Japan. These technologies were reviewed for their potential application to wastes generated in Ontario. OWMC is committed to using only the best, proven technologies and therefore only those technologies which have been successfully demonstrated in full-scale applications and a few in the development stage nearing commercialization were included.

Waste reduction, treatment and disposal technologies can be grouped into six generic process categories:

- waste abatement, reduction, reuse and recycling,
- biological waste treatment,
- physical and chemical treatment,
- thermal processing and waste destruction,
- solidification/stabilization and encapsulation,
- permanent disposal.

Waste abatement, reduction, reuse and recycling

Waste abatement, reduction, reuse and recycling operations reduce the quantity of waste requiring further treatment and disposal and tend to be unique for each industrial process.

In some industries the quantity of waste generated can be reduced by substituting "low-waste" for "waste-intensive" processes, implementing better housekeeping practices or installing waste concentration facilities. Direct reuse of a waste stream is sometimes possible through plant modifications. For example, by-product gases, liquids or solids are sometimes used for fuel.

Wastes from one industry can sometimes be used directly by another. For example, solvents used for contact cleaning or circuit board cleaning in the electronics industry are unsuitable after only slight contamination, but they can be used without purification by the paint industry. Reprocessing technologies, such as waste oil refining, can reclaim some valuable materials from waste streams.

Organic and oily wastes and a variety of solvent wastes have the greatest potential for recovery and reuse.

Physical and chemical treatment

Physical and chemical treatment technologies are fundamental to a waste management system. Physical treatment technologies generally separate components of the waste stream or change the physical form of the waste without altering the chemical structure of its constituents; chemical treatment technologies alter the chemical structure of the waste constituents to produce a less-hazardous or non-hazardous residue. Physical and chemical processes normally are built at the same location. These technologies have been proven in industrial applications for a wide range of waste streams. They produce liquid and solid but few gaseous residues.

Physical and chemical treatment technologies can be applied to many types of Ontario waste requiring special treatment.

Thermal processing and waste destruction

Thermal processing technologies use very high temperatures to change the chemical, physical or biological composition of a waste and are used mainly with organic wastes. Thermal processing systems generally achieve volume reduction and destruction/detoxification of the waste stream. In some cases energy and raw materials recovery are possible.

Gaseous emissions as well as liquid and solid residues are produced.

The high temperature rotary kiln incinerator has potential to burn most solid and liquid organic wastes. It is one of the "workhorses" of waste management systems in most modern waste treatment facilities in Europe and the USA.

The effectiveness of thermal processing is seriously limited in dealing with inorganic waste, which represents three-quarters of Ontario's special waste; but it is sometimes used to remove trace organics or to condition inorganic materials for other treatment.

Solidification/stabilization and encapsulation

Solidification and stabilization techniques improve the handling and physical characteristics of the waste stream, limit the solubility of the waste or chemically treat the hazardous constituents of the waste stream. Encapsulation techniques surround the waste material with an impermeable and chemically inert material.

Solidification/stabilization and encapsulation are a current and applicable technology for inorganic wastes and wastes with only a low organic content. Such waste types represent most of Ontario waste requiring special treatment.

Biological waste treatment

Sewage treatment plants use a form of this technology, in which micro-organisms biologically degrade the organics in the waste. Inorganic wastes and wastes with low organic content cannot be treated biologically. A wide range of biological treatment technologies exists. Currently the activated sludge process for waste water and the land farming process for oily sludges and organic wastes are the most used utilized full-scale applications of biological treatment in Ontario. Generally, wastes suitable for biological treatment can also be treated by other means such as physical/chemical or thermal processing.

Biological treatment techniques are applicable to types of waste accounting for about one-third of Ontario waste requiring special treatment.

Laboratory Analysis

The safe and efficient operation of a waste management system also depends on a system of monitoring laboratories. The main function of the laboratories will

be to verify the composition of every waste load received, to determine the appropriate treatment processes for each load, and to control the quality of processing by continual monitoring of flue gases, ambient air, ground water, waste water, and so on. No waste will be processed until its exact composition has been verified. Testing any leachate coming from a secure landfill will also be part of the monitoring program. Among other things, the laboratory records will help establish a treatment and disposal cost for a particular waste stream.

TREATMENT OPTIONS

As to which technologies at this time can be applied to special waste in Ontario, the Phase One studies suggest the following:

- Some form of waste abatement or recycling is possible for many of Ontario's waste streams; oil wastes and a variety of solvent wastes have the greatest potential.
- Most kinds of waste can be treated by several proven technologies; all wastes can be treated by at least one proven technology.
- The physical/chemical and thermal treatment systems produce an aqueous solution containing very small quantities of some residuals; this solution must be carefully monitored and given further treatment, if necessary, before it is discharged. This standard can best be met by using a waste water treatment facility, which would therefore be an important component of the entire system.
- The waste categories representing the great majority of Ontario wastes requiring special treatment can be handled best by physical/chemical treatment or incineration. Both these processes seem fundamental to a waste management system. As Figure 6 shows, about 60% of Ontario special waste would be most appropriately processed by physical/chemical treatment, and the remainder by incineration.
- Solidification/stabilization and encapsulation of inorganic waste is a current and applicable technology, when combined with secure landfill for disposal of the treated waste.
- All current major waste management systems reviewed incorporate some form of secure landfill as part of the system.

PERMANENT DISPOSAL OPTIONS

Modern waste treatment technologies decrease the volume of waste requiring land disposal, but they do not eliminate the need for this type of disposal altogether. Hazardous contaminants are treated and rendered nearly insoluble by these processes. The resulting solid residuals are then disposed of in a permanent facility.

The most widely accepted permanent disposal facility is a secure landfill, although other forms of geological isolation, such as deposition in underground mines or deep well disposal, are possible options. As part of OWMC's waste management system, a secure disposal facility will be located where stringent environmental standards can be met.

Secure landfill designs require different types of waste to be placed in separate compartments to preclude the mixing of incompatible wastes. Careful records of the contents of each compartment are kept, so that wastes will not simply be buried and forgotten. Perpetual monitoring in, around and under individual compartments for leakage will ensure that any toxic leachate produced is contained on the site. The source compartment can be identified and corrective measures taken as required. In addition, a permanent system of leachate collection and treatment is maintained.

To determine where suitable secure landfill sites and other treatment options could be most suitably located, OWMC commissioned a review and evaluation of the major geological/hydrogeological features of southern Ontario, the area where most special waste is generated. The objective of this review was to provide a preliminary evaluation of lands for siting facilities in relation to three key questions: a) what is the natural ability of the geological/hydrogeological setting to contain contaminants if they were accidentally released; b) what is the predictability within the hydrogeological setting of the behaviour of such substances; and c), in the unlikely event of such an accident, what amount of lead time does the setting provide for remedial measures to be taken?

On the basis of broad physiographic characteristics and geological/hydrogeological features, 261 regions were delineated south of the 46th parallel, just south of North Bay. Published information was collected, analysed and

recorded for each region. Each region was evaluated in a preliminary fashion to identify the hydrogeological factors that would affect the design of a secure landfill and other treatment options.

The 261 regions have been classified into one of six zones (Figure 7), and it is the first two zones (1 and 2 on the map) which have the most significant and potentially appropriate geological and hydrogeological features.

Zone 1 regions contain the most predictable and uniform sub-surface conditions for naturally restricting contaminant movement. Although local variations may exist, those regions are the most likely to contain suitable acreage with the required natural conditions for a secure landfill. These regions exist in the Niagara Peninsula, in southern and southwestern Ontario and, to a lesser extent, south of Ottawa. Areas in these regions have been found to contain ground water as old as the soil itself.

In Zone 2 regions - which are widespread in the most industrialized parts of the province and throughout southern Ontario - sub-surface conditions vary widely. They may well provide suitable secure landfill sites within their boundaries, although much of their areas is inappropriate.

Regions in Zones 3 to 6 contain sub-surface conditions that would provide little natural protection against the offsite escape of contaminants. A secure landfill in such a region probably would be <u>totally</u> reliant on an engineered design for restricting the movement of leachate.

POSSIBLE OWMC TREATMENT & DISPOSAL OF SPECIAL WASTE

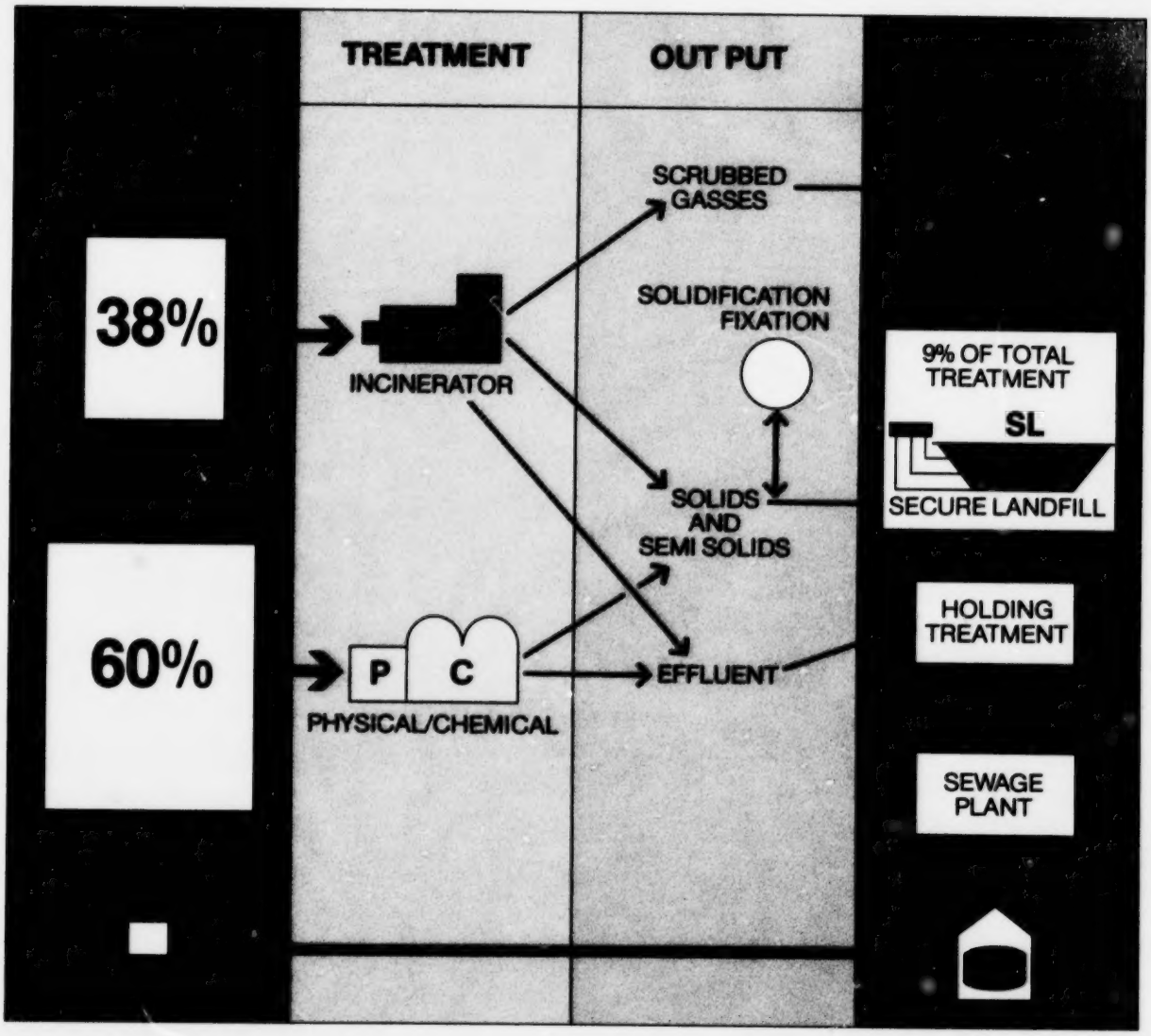


FIGURE 6

FIGURE 6

SUMMARY

- The main treatment and disposal technologies most applicable to Ontario can be grouped into the following generic processes:

    - physical and chemical treatment,
    - thermal processing (incineration),
    - permanent disposal (landfill).

  Several proven technologies are available in each category, and for all waste streams. Solidification/stabilization and encapsulation and biological treatment are possible additional processes. Waste reduction and recycling are also important components of the overall system, and are presently being examined in detail by OWMC consultants.

- Oily wastes and a variety of solvent wastes have the greatest potential for recovery and reuse.

- A waste water treatment facility is an important component of the treatment processes, to ensure any remaining minor residuals from these processes receive any further treatment necessary.

- The geological/hydrogeological inventory indicates that areas most likely to contain suitable secure landfill sites exist in the Niagara Peninsula, in southern and southwestern Ontario, and south of Ottawa.

5. SITING FACTORS AND SYSTEM OPTIONS

INTRODUCTION

The purpose of the Phase One studies is to provide the basis for outlining options for the proposed design of a waste treatment and disposal system. Although more detailed and specific studies will be conducted throughout the Facilities Development Process, the Phase One studies provide a starting point for a detailed evaluation of options (Phase Two) and for the selection of a prepared treatment and disposal system and location(s) (Phase Three).

Fundamental to this process is OWMC's belief that Ontario waste requiring special treatment can and must be reduced to the smallest quantity and least harmful state practical in an essentially insoluble form, which in turn will reduce the amount of waste material requiring secure disposal. Preliminary calculations would indicate (Figure 6) that 38% of Ontario Special Waste would lend itself to incineration in a high temperature rotary kiln, 60% to physical/chemical treatment and 2% would require special storage until a treatment process has been implemented. Residuals disposed of in a secure landfill would consistitute less than 10% of the volume of original special waste. In other words the waste reduction and treatment processes can and must be designed to shrink as far as possible the amount requiring landfilling. Studies conducted in Phase One indicate that the technologies available to achieve this and the opportunities for reusing or recycling this material are worthy of detailed study. There is no doubt that considerable scope remains in the private sector for waste abatement and recycling, and OWMC has an important role to play in this process. The exact nature of that role is the subject of a study of waste reduction opportunities now being conducted for OWMC by the Ontario Research Foundation.

Even with the utmost abatement and recycling, however, substantial quantities of special waste will still require treatment and ultimate disposal, and OWMC's facilities must be designed to handle a significant portion of these quantities.

The size and design of these facilities will be determined by many factors - economic, environmental, social and technical. Phase One has begun consideration

of some of the technical and environmental factors only, and in Phase Two and Three, detailed studies on economic and social considerations will be conducted.

KEY SITING REQUIREMENTS

Each of the principal components of a waste management system outlined in Chapter 4 - a physical/chemical treatment process, a thermal destruction process and a permanent disposal site - have explicit siting requirements, which will be important determinants of where they should each be located. The following summarizes the important siting factors identified by the Phase One studies, for each treatment component:

Physical/chemical treatment

A number of specific technologies are available for the physical and chemical treatment of almost all the Ontario wastes requiring special treatment. Chemical treatments tend to produce saline effluents that would require further treatment before entering the natural environment. This requirement is an important consideration in the design and location of physical/chemical facilities, because the removal of the saline components is generally not practical.

Physical/chemical facilities should ideally have access to a large sewer system to ensure necessary standards are met. This may be one of the most important siting conditions for physical/chemical treatment facilities, although on-site effluent treatment facilities are also a possibility.

Incineration

Very high temperatures are used to destroy certain wastes, mostly organic. Combustion must be controlled, flue gases must be monitored and residues and ash must be properly disposed of, generally in a secure landfill. Any scrubber waters from air pollution control systems are acidic and contain dissolved and suspended solids which must be further treated in the facility before being discharged. As outlined on page 29, atmospheric conditions for dispersal of flue gases are also important considerations. These factors must be considered in the siting of incineration facilities.

Secure landfill

The Corporation has adopted the principle that nothing hazardous will be deposited in its landfill facilities that has not been treated previously. It also has adopted guidelines which will ensure that the characteristics of the soil are predictable and will restrict the movement and promote the attenuation of leachate. The landfill will be designed and engineered to the most modern standards, but a crucial "line of defence" must be the natural hydrogeological and geological characteristics.

Secure landfill facilities are site-sensitive, and many areas in Ontario are not suitable for them. The best landfill site may also turn out not to be suitable for the location of treatment facilities.

Solidification/stabilization and encapsulation

The products of solidification are intended to be deposited in a secure landfill. None of the technologies is very site-sensitive; however, there may be an economic justification for locating such a facility on or very close to a permanent disposal site.

Biological treatment

The products of an activated sludge biological treatment facility are an aqueous effluent and sludge. The effluent might be discharged directly to a sewer system of sufficient size and convenience or may in some cases be discharged to an eligible receiving stream or body of water. The sludge may be landfilled directly or after further treatment.

OTHER TECHNICAL AND ENVIRONMENTAL FACTORS AFFECTING LOCATION

In addition to the main quantitative, technological and environmental studies, OWMC commissioned a number of smaller studies reviewing factors expected to need more detailed site-specific investigation at a later stage in the process of planning facilities. These studies (see Appendix C for title references) present some general conclusions that add depth to the picture emerging from the primary

information being collected and amplify many of the locational considerations discussed earlier. The chief findings of these ancillary studies are summarized here:

Engineering infrastructure

This study concludes that the provision of the services and utilities needed by a waste treatment facility, such as electricity, fuel and water supply, storm sewerage, transportation and other utilities, will not pose significant problems for a treatment facility in most areas of southern Ontario. Physical/chemical and thermal technologies both produce liquid effluents, however, that require dilution and dispersal. Essentially this means that such facilities must have pipeline access to a sewer system or other facility having a dilution capacity or else must be designed to incorporate such a discharge system and be appropriately located on an eligible large body of water. Large-scale gaseous effluents do not occur with physical/chemical treatment, but they are of course an important factor in thermal processing, where the incinerator must be located and designed to allow adequate atmospheric dispersion of flue gases.

Atmospheric conditions

Based on a review of atmospheric conditions in southern Ontario this study concludes that the dispersal of flue gases from an incinerator would require special design and operation considerations in the following areas:

- areas within about 2 km of the shoreline of the Great Lakes,
- areas between the Niagara Escarpment and Lake Ontario,
- major urban centres.

Abatement techniques can be developed in areas where poor dispersion conditions exist.

Subsequent specific studies of proposed sites will be conducted, based on local air quality and meteorological data.

Surface water inventory

This report reviews the natural capability of rivers and lakes in southern Ontario to receive treated liquid effluent and avoid interference with existing uses. Locations most vulnerable to interference include public beaches, near-shore and inland fish spawning areas, water intakes and effluent outlets, and these are mapped. Low flows in rivers and streams are portrayed and related to a range of possible physical/chemical treatment plant sizes. Large dilution capabilities are available in the interconnecting rivers of the Great Lakes and along portions of the major inland rivers. In the Great Lakes the chance of interference with important surface water uses is greater with a near-shore discharge; a properly designed diffuser placed where depths are at least 10m can achieve consistently high dilution.

In reviewing siting options, therefore, OWMC can consider either a connection to established sewer system with proper effluent discharge facilities or the choice of an appropriate site and the installation of its own effluent diffusion system.

Environmentally sensitive areas

This factor will be critical to the safe siting of facilities, and detailed studies of specific areas will be conducted once the system options have been identified in more detail. The work done to date by OWMC consultants has consisted of reviewing the type and location of recorded information, the authorities compiling and issuing such information, and the location of sources for more detailed study when candidate sites are being considered. A bibliography of provincial and regional studies published by provincial ministeries, conservation authorities, and municipalities has been compiled.

Archaeology

Archaeological assessment is required as part of formal environmental assessments in Ontario law. For this reason, OWMC has included this in the list of studies it will undertake. This study charts the densities of archaeological sites across southern Ontario, pointing out, however, that such densities may reflect exploration priorities as much as actual site distribution. It concludes that an intensive

archaeological survey should be conducted in the selected areas during the early planning stage. If an important archaeological site is found to occupy a selected area it can be incorporated into the plan, or various mitigation procedures can be undertaken that, with some delay, will allow construction to take place.

Transportation

This study emphasizes the importance of access to and use of the provincial highway system, which provides a continuous linkage of roadways built to structural standards between the cities and towns having the major waste generators. The provincial highway system provides better coverage and more flexibility than the rail network, although the latter is excellent where it exists. The roles of marine and pipeline transport systems probably will be fairly limited. A significant increase in the use of the provincial highway system, however, may mean that truck inspection procedures and contingency planning should be reviewed.

Land use

This study concludes that land use as a determinant in the siting process may be secondary to other more stringent factors. In general, some zones have less suitable characteristics - agricultural and recreational for example - than other zones; many of the more suitable zones are near the main transportation corridors where much of the waste-generating industry also is located. Detailed study and analyses of candidate areas will be needed.

In each of these studies the importance of site-specific analyses is emphasized.

SYSTEM OPTIONS

Clearly, any waste treatment system will consist of a number of separate technologies, and each technology has certain technical siting requirements. A central consideration is whether these technologies can or should be located all on one site (a centralized facility), where all the siting requirements for each technology can be found; or on more than one site (a decentralized facility), with the technologies appropriately allocated to several locations.

Selecting the best option will require an analysis of economic and social as well as technical and environmental factors. As a starting point, however, it is useful to summarize the basic characteristics of each option and the technical considerations that have been identified. Figure 8 shows examples of how the components of each option might be arranged.

A centralized system

The centralized option would locate all major treatment facilities on the same site as the secure landfill. This option offers the advantage of providing convenient disposal of the incinerator ash, the residues such as filter cake from the physical/chemical treatment, and the products of a solidification/stabilization and encapsulation facility. It might also result in lower capital and operating costs than a decentralized system. However, a centralized site must satisfy several exacting conditions: it must meet demanding environmental standards for a secure landfill; it must either have access to a sewer system with adequate capacity or be situated close to a large river or lake with significant dilution capabilities; it should be located as close as possible to major waste generation areas; it must have atmospheric conditions suitable for dispersal incinerator flue gases; and it would require more land than any individual site in a decentralized system.

This centralized option could be supported by local or regional collection and transfer stations where dewatering or bulking could occur, placed in appropriate regional locations to reduce the quantity of liquid waste requiring transport to the central facility.

A variation of the centralized option might be to have several sites, each with all the major technologies, serving regional catchment areas. Hauling costs might be lower than with a single provincially centralized system, but because the size of each facility would be reduced there would be a loss of economies of scale and operating efficiencies.

A decentralized system

A decentralized system contains many possible siting variations and could also incorporate regional collection and transfer facilities. With a partially decentralized system some or all of the treatment processes (physical/chemical and

incineration for example) could be located together if several features are present in one location: access to a sewer system or a suitable receiving body of water, and appropriate atmospheric conditions - all within reasonable transportation distances of waste generators. The secure landfill could be at a different location where acceptable hydrogeological and geological conditions exist. Alternatively, some of the less site-sensitive treatment processes (solidification/stabilization and encapsulation, for example) could be located on the same site as a secure landfill, with the other treatment processes on a separate site, or sites. In a more fully decentralized system an incinerator separate from the physical/chemical plant might reduce transportation costs and lower the costs of achieving adequate atmospheric dispersion.

IMPLEMENTATION CONSIDERATIONS

Even when a system is chosen it may not be practical to implement immediately a full-scale system - either centralized or decentralized. If this should occur, where should OWMC start in the development of the system; and what will the system be like in a few years?

Based on the information in the studies summarized in this report, the minimal starting point, if a phased approach were adopted, would appear to be the construction of at least one treatment process and one secure landfill. Anything else would leave unanswered the basic questions: if only a landfill, what would go into it; if only a treatment facility, where would its final products go? In principle, the optimal starting point might well be the creation of a province-wide system, developing all the appropriate technologies and regional collection and transfer stations concurrently. The feasibility of this course, however, must be thoroughly investigated.

The practicality of adopting some interim measures, designed to mitigate present problems while longer-term solutions are being developed, is a further, critical implementation consideration. Once the design and location(s) of the necessary treatment and disposal facilities has been approved, construction time is required. Could OWMC be doing something in the meantime to mitigate existing special waste management problems? Assisting in the reduction and recycling of waste is one avenue open to the Corporation, and a detailed Waste Reduction

Opportunities Study is now underway. Other possible measures - such as portable treatment processes, requiring less time to construct and implement, will also be examined by OWMC over the next few months.

PHASE ONE INFORMATION ON FACTORS AFFECTING LOCATION

The assessment of system options must include many siting factors - social, environmental, economic, technical and engineering - and each must be studied thoroughly before a preferred system can be selected. Moreover, the system cost of each option must be analysed to compare the competing alternatives. In Phase One, OWMC has collected information on such environmental issues as archaeology, land use data, climatology and surface water considerations, environmentally sensitive areas, transportation networks and engineering infrastructure. Analysing the collected data will be an important part of the Phase Two evaluation.

While there is a wide range of location possibilities - most in significant industrial waste generation areas of central and southwestern Ontario - there are several key factors contained in the information collected to date that will influence this decision:

- To minimize the costs and risks associated with waste transport, the treatment facilities should be located as close to major waste generation areas as possible. Since approximately 70% of all liquid industrial waste and hazardous waste is generated in the highly industrialized region around the western end of Lake Ontario, treatment facilities in particular would be most cost effective if located near this area. The engineering and technical information collected to date suggests this may be feasible.
- Approximately 58% of the estimated annual production of special waste is in liquid form. To reduce the quantity hauled to a treatment facility, particularly if it is part of a centralized system, regional transfer and dewatering stations would be desirable. Based on the geographical distribution of generated wastes, these collection areas could include Kingston/Ottawa, Windsor/Sarnia, London, Sault Ste Marie, Thunder Bay, and Sudbury/North Bay.

- A fully centralized facility would require the largest individual site of any option. Studies to date suggest it may be difficult to find an acreage suitable for such a facility on industrially zoned or crown-owned land within the Zone 1 hydrogeological/geological regions. However, that may be possible within Zone 2. More detailed analysis is required of industrial parks, crown land and available industrially zoned land located in Zone 2 regions, particularly in the Toronto-Hamilton area, to assess the likelihood of finding a suitable acreage for a fully centralized facility near the centre of the greatest concentration of waste generation. While OWMC will be investigating this thoroughly, the possibility of acquiring privately-owned land cannot yet be ruled out.
- Most of the treatment technologies produce aqueous solutions containing very small amounts of residuals that should ideally be handled by connection to a sewer system or some other means of proper monitoring and further treatment if necessary. This is one of the most important siting requirements for treatment facilities. It is not yet known whether these requirements can be met in an area with the preferred hydrogeological/geological conditions for a secure landfill.
- Evaluation of key environmental issues such as archaeology and climatology as well as land use and transportation factors show that their importance will vary between potential sites. Specific analyses at a later stage will be essential.

EXAMPLES OF ARRANGEMENTS OF TREATMENT AND DISPOSAL COMPONENTS

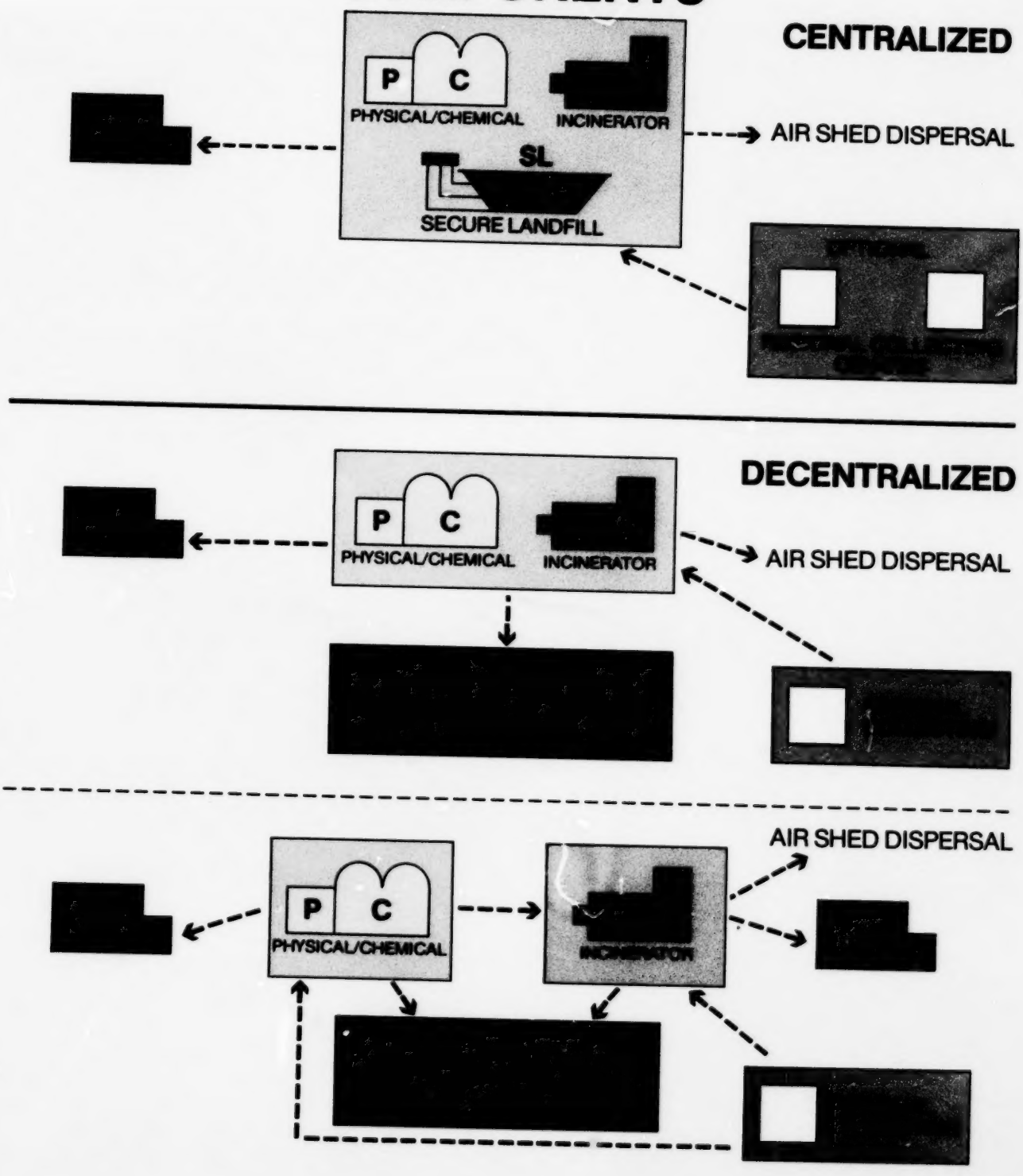


FIGURE 8

FIGURE 8

SUMMARY

- OWMC's liquid industrial waste and hazardous waste management system is likely to have at least three principal physical components: physical/chemical treatment facilities, an incineration process and a secure landfill.

- While there is a wide range of location possibilities - most in significant industrial waste generation areas of central and southwestern Ontario - there are several key factors contained in the information collected to date that will influence this decision:

  - To minimize the costs and risks associated with waste transport, the treatment facilities should be located as close to major waste generation areas as possible. Since approximately 70% of all liquid industrial waste and hazardous waste is generated in the highly industrialized region around the western end of Lake Ontario, treatment facilities in particular would be most cost effective if located near this area. The engineering and technical information collected to date suggests this may be feasible.

  - Approximately 58% of the estimated annual production of special waste is in liquid form. To reduce the quantity hauled to a treatment facility, particularly if it is part of a centralized system, regional transfer and dewatering stations would be desirable. Based on the geographical distribution of generated wastes, these collection areas could include Kingston/Ottawa, Windsor/Sarnia, London, Sault Ste Marie, Thunder Bay, and Sudbury/North Bay.

  - A fully centralized facility would require the largest individual site, of any option. Studies to date suggest it may be difficult to find an acreage suitable for such a facility on industrially zoned or crown-owned land within the (Zone 1) hydrogeological/geological regions. More detailed analysis is required of industrial

parks, crown land and available industrially zoned land located in Zone 2 regions, particularly in the Toronto-Hamilton area, to assess the likelihood of finding a suitable acreage for a fully centralized facility near the centre of the greatest concentration of waste generations.

- Most of the treatment technologies produce aqueous solutions containing very small amounts of residuals that must be handled by connection to a sewer system or some other means of proper monitoring and further treatment if necessary. This is one of the most important siting requirements for treatment facilities. It is not yet known whether these requirements can be met in an area with the preferred hydrogeological/geological conditions for a secure landfill.

- Evaluation of key environmental factors such as archaeology and climatology, as well as land use and transportation factors show that their importance will vary between potential sites. Specific analyses at a later stage will, therefore, be essential.

6. LOOKING AHEAD

This report has summarized a large amount of information contained in studies conducted for OWMC over the past several months. Waste quantities and their type and location have been estimated; treatment and disposal options have been suggested; and the factors contained in these studies that will significantly influence the choices to be made by OWMC have been identified. What is OWMC proposing to do with this information? What process will be used to select specific treatment and disposal technologies and their preferred locations? And how long will this take? These are all questions which must be addressed as the Corporation moves into the next phase of its work.

This next phase - Phase Two of the Facilities Development Process - is designed to evaluate the options outlined in this report, and will conclude with an outline of several specific facility options; each option will include the types of components and their general locations. OWMC will indicate its preference for certain of the options identified and, with the assistance of further detailed studies and public discussion will narrow the short list to a preferred facilities configuration and specific site(s) recommendations.

PHASE TWO STUDIES

Further investigations will be required in order to produce a series of candidate systems and general locations, and OWMC has identified the following studies and activities to be undertaken during Phase Two:

- verification of the definition of special waste and estimates of quantities;
- an initial market estimate of types and quantities of waste likely to be brought to OWMC facilities for treatment and disposal and a review of possible pricing policies;
- preliminary estimates of the size of facilities and processes required, based on the above;
- examination in greater detail of factors such as environmentally sensitive areas, transportation distances, engineering considerations, land use, geology and hydrogeology and other environmental considerations.

This information will be evaluated in conjunction with public discussions to produce the proposed series of specific system options. Descriptions of these options together with backup material and OWMC's statement of preferences will be issued in a Phase Two report, and will form the basis of the Phase Three public consultation process.

PHASE TWO PUBLIC CONSULTATIONS

During the next several weeks, OWMC staff will be meeting with the groups and individuals who have expressed an interest in participating in the Facilities Development Process. This report will be widely distributed, and copies of the more detailed studies on which it is based are available, and will be placed on deposit in several regional libraries in southern Ontario (see Appendix C).

Meetings will also be scheduled where the information contained in this report can be discussed in more detail. Specifically, OWMC will be seeking meetings with:

- waste generating and handling industries;
- environment and planning committees of agricultural, labour, municipal and industrial organizations;
- environmental and other citizen groups throughout southern Ontario;
- waste management officials with transportation, processing, recycling and treatment responsibilities;
- municipal and provincial government officials;
- professional organizations.

Individuals and groups wishing to obtain further information or clarification on the Phase One studies, or those seeking to present their views, are asked to contact OWMC either by writing Michael Scott, Director of Communications, Ontario Waste Management Corporation, 60 Bloor Street West, Suite 707, Toronto, M4W 3B8, or by calling the Corporation at 416-963-1162 (or toll free number 1-800-268-1179) and asking to speak to Mr Scott or to one of the Communications staff.

KEY ISSUES TO BE ADDRESSED

As a guide to the public consultation program in Phase Two, it is helpful to outline some of the key questions that OWMC must address, and is seeking suggestions on, over the next several weeks. This list is not meant to be inclusive - additional questions and issues no doubt will be raised - but the following may be helpful as an 'agenda' for discussion:

- How far and how fast should OWMC go to assist industries in attempting to reduce and recycle waste?
- Is the Facilities Development Process basically sound, or has it either omitted or placed too great an emphasis on a specific issue or concern?
- What emphasis should OWMC place on key issues of transportation costs and risks and the economies to be achieved in selecting and locating the required technologies?
- What priority should be placed on environmental and land use factors, particularly in relation to transportation and treatment facility costs?
- What implementation policy should OWMC adopt: recommend the implementation of the basic components first and phase in the rest; or recommend the implementation of a complete system concurrently?
- Are there interim measures OWMC should adopt, that would require less time to implement than the type and number of possible facilities outlined in this Report?
- What additional factors should be considered in the process of narrowing the options? In what depth should they be examined?
- Are the conclusions OWMC has drawn to date on such key issues as definitions of waste, and the classification of this material and treatment and disposal technologies, reasonable and appropriate? Should other or additional treatment and disposal technologies be considered?

Finally, a word on timing. To stay on schedule, the Facility Development Process requires that the Phase Two evaluation, with the public consultations it entails, should be completed in early November 1982. Following this phase a further report will be issued, summarizing the results of the evaluation and

outlining the system options and locations that OWMC, at that time, feels should be considered in detail. Public consultations will be continued in Phase Three, in which the preferred system option is to be selected.

APPENDIX A

CONSTITUENTS OF SPECIAL WASTE

UCD WASTE	DESCRIPTION	TYPICAL WASTES	Estimated Waste Quantity (tonnes)
11 ACIDIC SOLUTIONS			
111	Acidic Solution with Heavy Metals	Pickle Liquor Rinse Water	149,000
112	Acidic Solution with Other Metals and Non-Metals	Demineralizer Regenerent	800
113	Other Acidic Solutions	Boiler Stack Scrubber Water with Dilute Carbonic Acid (H_2CO_3)	22,600
12 ALKALINE SOLUTIONS			
121	Alkaline Solution with Heavy Metals	Rinse Waters from Surface Cleaning of Metals	19,500
122	Alakaline Solution with Other Metals	Demineralizer regenerent	700
123	Other Alkaline Solutions	Cleanup Water from Lime or Cement Kiln	55,200
13 METAL FINISHING SOLUTIONS			
131	Metal Finishing Solutions, Acid	Ammonia Based, Containing Copper, Tin, Lead or Cadmium	9,900
132	Metal Finishing Solutions, Alkaline	Contains Strong Complexing Agent and Copper, Tin, Lead and/or Cadmium	1,100
133	Spend Pickle Liquor from Ferrous and Non Ferrous Metals	Strong Acids with Iron, Fluoride, Hydrochloric Acid (HCl), Sulfuric Acid (H_2SO_4), Nitric Acid (HNO_3)	213,400

APPENDIX A (CONTINUED)
CONSTITUENTS OF SPECIAL WASTE

UCD WASTE	DESCRIPTION	TYPICAL WASTES	Estimated Waste Quantity (tonnes)
14 OTHER AQUEOUS SOLUTIONS			
141	Aqueous Solutions with Heavy Metals	Cleaning Solutions from Tanks, Trucks, or Railroad Tankers	32,300
142	Aqueous Solutions with Other Metals	Rinse Water from Heat Treating Salt Baths, Contain Barium, Aluminum	200
143	Aqueous Solutions with Reactive Anions	Bleaching Solutions Containing Sulfite, Chlorite, Fluoride, Bromate	2,900
145	Brine	Salt Solutions After Neutralization or Chlor/Alkali Production	5,400
146	Solutions Containing Cyanide	Plating Baths	4,800
147	Solutions Containing Sulfides	Plating Baths	2,600
15 INORGANIC SOLIDS			
151	Inorganic Solids	Foundry Sand with Phenolics	133,000
152	Inorganic Solid Chemicals	Aged or Off Spec. Chemicals Including Lime, Caustic Soda and Partial Containers of Laboratory Size	132,100
16 OTHER INORGANIC WASTES			
165	Spent Catalyst	Maybe Carbon or Metal	2,000
167	Other Inorganic Waste	Ash and Construction Residue	1,700

APPENDIX A (CONTINUED)

CONSTITUENTS OF SPECIAL WASTE

UCD WASTE	DESCRIPTION	TYPICAL WASTES	Estimated Waste Quantity (tonnes)
21 SPENT SOLVENTS			
211	Halogenated Solvents with Heavy Metals	Methylene Chloride, 1, 1, 1, Trichloroethylene Used for Metal Cleaning	3,700
212	Halogenated Solvents with Other Metals	Surface Cleaning and Degreasing Solvents	< 100
213	Other Halogenated Solvents	Freon with Other Solvents Used in Chemical Processing	2,000
214	Non-Halogenated Solvents with Heavy Metals	Toluene, Benzene, Xylene Contaminated with Catalysts	17,500
215	Non-Halogenated Solvents with Other Metals	Acetone, Methylisobutylketone (MIBK) used in Paint and Varnish Formulation	300
216	Other Non-Halogenated Solvents	Methylethylketone and Other Solvents Contaminated with Dirt	4,700
217	Unspecified Solvents	Alcohols and Mixtures of Solvents	700
22 OTHER ORGANIC LIQUIDS			
221	Organic Liquids with Metals and Halogens	Dyes	<100
222	Organic Liquids with Halogens Only	Chloroform, Carbon Tetrachloride	900
223	Organic Liquids with Metals Only	Nickelcarbonyl, Methyl Mercury	200
224	Other Organic Liquids	Creosote and Other Poly Aromatic Hydrocarbons	12,200
225	Aqueous Solution with Non-Halogenated Residues Less Than 10%	Laboratory Mixtures	3,100
226	Aqueous Solutions with Halogenated Residues Less Than 10%	Waste or Rinse Waters After Degreasing	1,000

APPENDIX A (CONTINUED)
CONSTITUENTS OF SPECIAL WASTE

UCD WASTE	DESCRIPTION	TYPICAL WASTES	Estimated Waste Quantity (tonnes)
227	Aqueous Solution with Non-Halogenated Organic Residue Greater Than 10%	Laboratory Mixtures	200
228	Aqueous Solution with Halogenated Organic Residue Greater Than 10%	Wash or Rinse Waters after Degreasing	100
24 - 25 OTHER ORGANIC WASTES			
241	Pesticides and Wastes	Partial Containers, Tank Washings, Off Spec. Product, etc.	600
242	PCB Oils and High Strength (over 500 ppm) Liquids	From Transformers and Capacitors	200
243	Pharmaceuticals and Wastes	Off-Spec. Drugs, Cleanup Waters, etc. Includes Items such as Vitamins	1,700
244	Photochemical Waste	Most Solutions Non-Toxic Except those with Silver	5,000
245	Off-Spec or Aged Organics	Can Include Solids or Liquids. Generally in Containers	200
247	Halogenated Still Bottoms	Spent Solvent or Waste Oil Recovery	2,500
248	Non-Halogenated Still Bottoms	Solvent Recovery Operations	7,500
251	Tannery Wastes - Liquid	Solutions with Hexavalent Chromium.	1,900
252	Solid or Sludge Tannery Wastes	Leather Shavings with Chrome,	1,000
254	Adhesives or Glue	Waste Glues Mostly Aqueous. Some with Phenols	< 100

APPENDIX A (CONTINUED)
CONSTITUENTS OF SPECIAL WASTE

UCD WASTE	DESCRIPTION	TYPICAL WASTES	Estimated Waste Quantity (tonnes)
257	Phenolic Wastes	Phenolic Oil. Toluene Diisocyanide Residue	1,900
258	Waste Tar and Residues		900
26 POLYMERIC MATERIAL WASTES			
261	Polymeric Resin	Polyester, Urethane, Etc.	1,400
262	Latex Wastes	Cleanup Water, Paint, Latex and Acrylic Resins	9,600
263	Other Polymeric Wastes	Kettle Bottoms, Thermoplastic Resins,	1,400
264	Thermoset Wastes	Urea-Formaldehyde and Thermoset Wastes	1,400
28 OILY WASTES			
281	Waste Oil and Mixed Oil	Used Automotive Oil, Hydraulic Oil, Cutting Oil - May Contain Solvents or Metals	46,600
282	Oily Tank Bottoms	Crude Oil or Sludge from Storage	29,800
283	Oily Mud, Sediment and Water	Crude Oil Tanker Cleaning	69,000
284	Oily Acidic Solids	Solids from Emulsion Breaking and Re-Refining	10,400
285	Oily Alkaline Solids	Refining Solids	6,900
286	Oil/Water Separator Sludge	Oil Cooled Heavy Inorganics	5,000
288	Oily Wastes with Heavy Metal Contaminants	Steel Rolling Mill Sludges and Mill Scale	169,200
289	Oily Wastes with Water	Emulsions, Cleanup Water from Garages, Cooling Waters	100

APPENDIX A (CONTINUED)
CONSTITUENTS OF SPECIAL WASTE

UCD WASTE	DESCRIPTION	TYPICAL WASTES	Estimated Waste Quantity (tonnes)
41 RELATIVELY INERT SLUDGES			
416	Ink Sludge	Sludge Could Contain Solvents, and Lead, Cesium, Chromium	4,100
417	Alum and Gypsum Sludges	Waste Water Phosphate. Removal Sludge	1,100
43 METAL SLUDGES			
431	Heavy Metal Sludge	Similar to that in 111, 113, 121, 123, 132, 133, 141,	43,800
433	Other Metal Sludges	Ferric Chloride, Aluminum Oxide, etc.	9,200
44 - 45 OTHER SLUDGES			
441	Lime Sludges	From Treatment of Acids and Similar to 431 and Derived from 111, 113, 121, 123, 131, 132, 133, 141	51,700
443	Sulfur Sludge	Desulfurization of Flue Gas Non-reactive but Very Low Bearing Strength	1,500
444	Cyanide Bearing Sludge	Pot Liners from Aluminum Reduction and Scrubber Sludge from Blast Furnace	27,400
445	Plating or Metal Finishing Sludge	Derived Mostly from 131, 132, 133	6,600
446	Degreasing Sludge	Grease and Oily Soil Containing Trichloroethane (TCE)	28,500
447	Tetraethyl Lead Sludge	Tank Bottoms	< 100
454	Paint Sludge	Drum Bottoms, Spills, Cleanup, etc.	30,600
455	Paint Sludge Without Heavy Metals	Mostly Latexc,	7,600

APPENDIX A (CONTINUED)

CONSTITUENTS OF SPECIAL WASTE

UCD WASTE	DESCRIPTION	TYPICAL WASTES	Estimated Waste Quantity (tonnes)
50 - 53 MISCELLANEOUS			
509	Gas Cylinders or Containers	Oxygen Cylinders - Empty	100
512	Spill Cleanup	Oil/Soil Mixture	3,100
513	Laboratory Waste Chemicals	Partially Full Small Containers	1,200
518	Dust Collector Wastes	Dry Lime from Dust Control Baghouse	55,500
521	Spent Cartridge Filters	Air Cleaning Filters on Ventilation System	100
523	Tank Bottom Sediments		3,500
528	Pathogenic Wastes	Used Bandages, Dressings	2,000
531	Contaminated Rags	Cleanup Materials	300
532	Equipment and/or Containers Contaminated with Pesticides	Empty Pesticide Cans	1,800
			1,490,300

APPENDIX B

UCD WASTE CLASSIFICATIONS EXCLUDED FROM SPECIAL WASTE

(Deemed to be outside OWMC Mandate and hence quantities not calculated)

UCD Number	Waste Category	Description
144	Other aqueous solution	Aqueous solutions (14) other than 141, 142, 143, 145, 146, or 147.
161	Asbestos-containing wastes	
162	Aluminum or tin wastes.	
231	Organic solids with halogens	Polyvinyl.
232	Organic solids without halogens	Polyethylene
253	Detergent and soap.	Liquid, aqueous waste solutions and organic solids from production or cleaning operations.
255	Unspecified organic wastes.	Organics not listed in other categories.
271	Sewage sludge	
272	Other Biological Wastes	Including animal fat, molasses wastes and dough.
412	Filter cake	Contaminated filter material, e.g., diatomaceous earth.
413	Gas scrubber sludge.	From gas cleaning operations.
442	Phosphate sludge.	
453	Paper sludge/pulp.	Paper and cardboard manufacture source.
456	Other waste treatment sludge.	Sludges not otherwise identified due to lack of composition data.
457	Sludges with organic residues.	Includes some halogenated components.
510	Flue-gas scrubber liquid.	
511	Rinse water and waste water.	Contains small units of oil, solvent, metals and/or mud; also bilge water.
514	Contaminated oil and sand.	

APPENDIX B (CONTINUED)

UCD WASTE CLASSIFICATIONS EXCLUDED FROM SPECIAL WASTE

(Deemed to be outside OWMC Mandate and hence quantities not calculated)

UCD Number	Waste Category	Description
515	Drilling mud.	
519	Fly ash and retort ash.	Combustion-generated particulates mineral matter plus some carbon
524	Chemical toilet wastes.	
525	Metal dust and machining wastes	Primarily ferrous and aluminum-based alloys.
526	Cannery wastes.	
527	Mud/sediment and water.	
530	Contaminated pallets.	
533	Contaminated equipment and containers	Contaminants not stated.
535	Totally unspecified wastes	Used only for California manifest purposes.

Note: These classifications, along with those in Appendix A, constitute the complete UCD classification system.

APPENDIX C

LICENSED RECEIVERS OF LIQUID INDUSTRIAL WASTE IN ONTARIO[1]

NAME	LOCATION	FACILITY TYPE/CAPACITY	TYPE OF WASTE RECEIVED MINISTRY OF THE ENVIRONMENT WASTE CLASSIFICATION	QUANTITY OF WASTE RECEIVED APRIL 1/81 TO MAR. 31/82 (AUGUST 1/80 TO JULY 31/81) (IMPERIAL GALLONS)	COMMENTS
INCINERATION:					
TRICIL	Corunna	Incinerator (Horizontal Chamber Unit)/ 200 litres per minute	• Acids • Alkalis • Metal Finishing Wastes • Cyanides • Chemical Fertilizer Waste • Phosphates • Other Inorganic • Oily Water • Waste Oils • Organic Solvents • Chlorinated Solvents • Plastic Resins • Amines • Glycols • Phenols • Other Organic • Pigments, Paints, Printing and Adhesives • Pesticides • Detergents, Cleaners & Soaps • Pharmaceutical & Cosmetics • Plant and Animal Wastes • Inert Sludges	14,302,702 (15,610,496)	• Other activities include: - on-site landfill - receiving tankage - solids separation (screening and clarification) - pH adjustment • $5 million plant modification plan approved in February/82 - new incinerator and stack construction - air pollution control and plant monitoring • Incineration capacity will increase to 260 litres per minute
SYNTATH	St. Catharines	Incinerator	• Organic solvents • Other organic • Pharameutical and Cosmentics • Plant and Animal wastes	15,012 (17,295)	• On-site storage of solvents for resale recently approved by M.O.E. • Activities also include transfer and spill cleanup
TOTAL INCINERATION				14,317,714 (15,627,791)	
LANDFILL:					
ARNPRIOR	Township of McNab	Landfill	• Other inorganic • Oily Water	121,306 (142,886)	

1. Source: Ministry of the Environment - Waybill Records August 1st, 1980 to July 31st, 1981, and April 1st, 1981 to March 31st, 1982.

APPENDIX C (CONTINUED)

LICENSED RECEIVERS OF LIQUID INDUSTRIAL WASTE IN ONTARIO[1]

NAME	LOCATION	FACILITY TYPE/CAPACITY	TYPE OF WASTE RECEIVED MINISTRY OF THE ENVIRONMENT WASTE CLASSIFICATION	QUANTITY OF WASTE RECEIVED APRIL 1/81 TO MAR. 31/82 (AUGUST 1/80 TO JULY 31/81) (IMPERIAL GALLONS)	COMMENTS
TOWNSHIP OF HAMILTON	Township of Hamilton	Landfill	• Plastic Resins	380,600 (422,700)	
CITY OF PARIS	Paris	Landfill	• Oily Water • Plant and Animal Wastes • Inert Sludges	163,000 (117,400)	
CITY OF BRANTFORD	Brantford	Landfill	• Pigments, Paints, Printing and Adhesives • Detergents, Cleaners & Soaps • Plant and Animal Wastes • Inert Sludges	1,193,310 (1,246,583)	
CITY OF GUELPH	Guelph	Landfill	• Phosphates • Other inorganic • Other organic • Pigments, Paints, Printing and Adhesives • Inert Sludges	870,475 (846,400)	
CITY OF WELLAND	Welland	Landfill	• Inert Sludges	348,800 (405,900)	
CITY OF BARRIE	Barrie	Landfill	• Oily Water • Pigments, Paints, Printing and Adhesives • Pharmaceutical and Cosmetics	33,630 (34,305)	
TRICIL	Corunna	Landfill	• Acids • Alkalis • Metal Finishing Wastes • Cyanides • Phosphates • Other Inorganic • Oily Water • Waste Oils • Organic Solvents • Amines • Glycols • Phenols • Other Organic • Pigments, Paints Printing and Adhesives • Pesticides • Detergents • Plastic Resins	5,899,993 (6,259,469)	

1. Source:
Ministry of the Environment - Waybill Records August 1st, 1980 to July 31st, 1981 and April 1, 1981 to March 31st, 1982.

APPENDIX C (CONTINUED)

LICENSED RECEIVERS OF LIQUID INDUSTRIAL WASTE IN ONTARIO[1]

NAME	LOCATION	FACILITY TYPE/CAPACITY	TYPE OF WASTE RECEIVED MINISTRY OF THE ENVIRONMENT WASTE CLASSIFICATION	QUANTITY OF WASTE RECEIVED APRIL 1/81 TO MAR. 31/82 (AUGUST 1/80 TO JULY 31/81) (IMPERIAL GALLONS)	COMMENTS
RIDGE LANDFILL	Township of Harwich	Landfill	• Acids • Phosphates • Alkalis • Oily Water • Metal Finishing Wastes • Other Inorganic • Waste Oils • Organic Solvents • Chlorinated Solvents • Plastic Resins • Other Organic • Pigments, Paints, Printing and Adhesives • Detergents, Cleaners and Soaps • Pharmaceuticals and Cosmetics • Plant and Animal Wastes • Inert Sludges	949,588 (1,876,992)	This site no longer receives liquid industrial waste
TOWNSHIP OF MARIPOSA	Township of Mariposa	Landfill	• Inert Sludges	195,000 (132,000)	This site no longer receives liquid industrial waste
REGIONAL MUNICIPALITY OF HALTON	Oakville	Landfill	• Inert Sludges	(23,676)	This site no longer receives liquid industrial waste
REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH	Hamilton	Landfill	• Inert Sludges	(13,200)	This site no longer receives liquid industrial waste
ERIC PAUZE CONSTRUCTION	Township of Tiny	Landfill	• Metal Finishing Wastes • Oily Water • Organic Solvents • Chlorinated Solvents • Pigments, Paints, Printing and Adhesives • Plant and Animal Wastes • Inert Sludges	(82,615)	This site no longer receives liquid industrial waste
ROMEO LANDFILL SITE	Stratford	Landfill	• Inert Sludges		This site no longer receives liquid industrial waste
TOTAL LANDFILLS				10,155,702 (11,621,576)	

1. Source: Ministry of the Environment - Waybill Records August 1st, 1980 to July 31st, 1981 and April 1st, 1981 to March 31st, 1982.

APPENDIX C (CONTINUED)

LICENSED RECEIVERS OF LIQUID INDUSTRIAL WASTE IN ONTARIO[1]

NAME	LOCATION	FACILITY TYPE/CAPACITY	TYPE OF WASTE RECEIVED MINISTRY OF THE ENVIRONMENT WASTE CLASSIFICATION	QUANTITY OF WASTE RECEIVED APRIL 1/81 TO MAR. 31/82 (AUGUST 1/80 TO JULY 31/81) (IMPERIAL GALLONS)	COMMENTS
PRIVATE LANDFILLS AND SLUDGE FARMS:					
SHELL CANADA	Oakville	Sludge Farm	• Waste Oils	(2,642)	No Waybill activity between April 1, 1981 and March 31/82
JOHNS MANVILLE	Scarborough	Sludge Farm		(3,600)	See above
IMPERIAL OIL	Sarnia	Sludge Farm	• Oily Water • Inert Sludges • Waste Oils • Other Organic	2,467,188 (3,151,810)	
DOW CHEMICAL	Sarnia	Private Landfill	• Alkalis • Plastic Resins • Plant and Animal Wastes • Inert Sludges • Glycols • Other Organic	2,768,630 (2,592,588)	
ABITIBI PROVINCIAL	Halton Hills	Private Landfill	• Chlorinated Solvents • Plastic Resins • Other Organic • Pigments, Paints, Printing and Adhesives	578,700 (633,900)	
BRITISH PETROLEUM REFINERY	Oakville	Sludge Farm	• Oily Wastes • Other Organic	(219,500)	No Waybill activity between April 1, 1981 and March 31/82
TOTAL PRIVATE LANDFILLS AND SLUDGE FARMS				5,814,518 (6,604,040)	

1. Source: Ministry of the Environment - Waybill Records August 1st, 1980 to July 31st, 1981 and April 1st, 1981 to March 31st, 1982.

APPENDIX C (CONTINUED)

LICENSED RECEIVERS OF LIQUID INDUSTRIAL WASTE IN ONTARIO[1]

NAME	LOCATION	FACILITY TYPE/CAPACITY	TYPE OF WASTE RECEIVED MINISTRY OF THE ENVIRONMENT WASTE CLASSIFICATION	QUANTITY OF WASTE RECEIVED APRIL 1/81 TO MAR. 31/82 (AUGUST 1/80 TO JULY 31/81) (IMPERIAL GALLONS)	COMMENTS
WATER POLLUTION CONTROL PLANTS:					
PORT DALHOUSIE	St. Catharines	Water Pollution Control Plant	• Plant and Animal Wastes	9,600 (6,400)	
WESTERLY PLANT	Windsor		• Other Inorganic • Other Organic	(112,000)	No Waybill activity between April 1, 1981 and March 31, 1982
LITTLE RIVER PLANT	Windsor	Water Pollution Control Plant		(4,000)	See above
HIGHLAND CREEK	Toronto	Water Pollution Control Plant	• Acids	(5,000)	See above
NORTH DON	Toronto	Water Pollution Control Plant	• Pigments, Paints, Printing and Adhesives • Plant and Animal Wastes	4,000 (13,525)	
ASHBRIDGES BAY	Toronto	Water Pollution Control Plant	• Acids • Waste Oils • Other Organic • Plant and Animal Wastes • Other Inorganic • Oily Water	36,900 (433,655)	
HOLLAND LANDING	Newmarket	Lagoon	• Phosphates	160,880 (166,000	
BAKER ROAD	Grimsby	Water Pollution Control Plant	• Other Organic • Plant and Animal Wastes • Phosphates • Other Inorganic	1,139,600 (129,000)	
CLARKSON	Mississauga	Water Pollution Control Plant	• Alkalis • Other Inorganic • Oily Water • Detergents, Cleaners and Soaps • Plant and Animal Wastes • Other Organic	697,827 (524,987)	
BARRY'S BAY	Barry's Bay	Water Pollution Control Plant	• Alkalis	6,776 (10,326)	

1. Source:
Ministry of the Environment - Waybill Records August 1st, 1980 to July 31st, 1981 and April 1st, 1981 to March 31st, 1982.

APPENDIX C (CONTINUED)

LICENSED RECEIVERS OF LIQUID INDUSTRIAL WASTE IN ONTARIO[1]

NAME	LOCATION	FACILITY TYPE/CAPACITY	TYPE OF WASTE RECEIVED MINISTRY OF THE ENVIRONMENT WASTE CLASSIFICATION	QUANTITY OF WASTE RECEIVED APRIL 1/81 TO MAR. 31/82 (AUGUST 1/80 TO JULY 31/81) (IMPERIAL GALLONS)	COMMENTS
HAMILTON	Hamilton	Water Pollution Control Plant	• Other Organic • Detergents, cleaners and Soaps	241,500 (18,000)	
BELLEVILLE	Belleville	Water Pollution Control Plant	• Other Inorganic • Oily Water • Organic Solvents • Other Organic • Detergents, cleaners and Soaps • Plant and animal wastes	202,800 (167,200)	
MIDLAND	Midland	Water Pollution Control Plant	• Inert Sludges	4,000 (10,000)	
HUMBER PLANT	Etobicoke	Water Pollution Control Plant	• Other Inorganic	7,000 (7,000)	
NIAGARA FALLS	Niagara Falls	Water Pollution Control Plant	• Plant and Animal Wastes	8,000 (5,600)	
DUFFIN CREEK	Pickering	Water Pollution Control Plant	• Inert Sludges	3,050	
HARMONY CREEK	Whitby	Water Pollution Control Plant	• Inert Sludges	2,350	
PETERBOROUGH	Peterborough	Water Pollution Control Plant	• Inert Sludges	9,800	
KITCHENER	Kitchener	Water Pollution Control Plant	• Inert Sludges	138,932	
GANANOQUE	Gananoque	Lagoon	• Inert Sludges	13,800	
B.P. REFINERY	Oakville	Water Pollution Control Plant	• Oily Water	53,100	
FALCONBRIDGE NICKEL	Sudbury	Water Pollution Control Plant	• Oily Water	2,500	

1. Source: Ministry of the Environment - Waybill Records August 1st, 1980 to July 31st, 1981 and April 1st, 1981 to March 31st, 1982.

APPENDIX C (CONTINUED)

LICENSED RECEIVERS OF LIQUID INDUSTRIAL WASTE IN ONTARIO[1]

NAME	LOCATION	FACILITY TYPE/CAPACITY	TYPE OF WASTE RECEIVED MINISTRY OF THE ENVIRONMENT WASTE CLASSIFICATION	QUANTITY OF WASTE RECEIVED - APRIL 1/81 TO MARCH 31, 1982 (AUG. 1/80 TO JULY 31/81) (IMPERIAL GALLONS)	COMMENTS
DuPONT OF CANADA	Maitland	Water Pollution Control Plant	• Oily Water	6,000	
CHRYSLER CANADA	Windsor	Water Pollution Control Plant	• Oily Water	6,000	
TOTAL WATER POLLUTION CONTROL PLANTS				2,754,415 (1,612,693)	
RECLAIMERS/REUSERS					
ANACHEMIA SOLVENTS	Mississauga	Reclaimer	• Organic Solvents • Chlorinated Solvents • Other Organic	52,245 (88,700)	
THOMAS WASTE REMOVAL	Mississauga	Reuser	• Other Inorganic • Oily Water • Other Organic	(25,530)	No Waybill activity between April 1, 1982 and March 31st, 1982
TEXACO	Mississauga	Reuser	• Oily Water	(7,500)	See above
GULF OIL	Mississauga	Reuser	• Other Inorganic	(3,000)	See Above
THOMSCAN INDUSTRIAL SERVICES	Mississauga	Reuser	• Oily Water	291,966 (78,010)	
INDUSTRIAL CHEMICAL	Toronto	Reclaimer	• Chlorinated Solvents	1,700 (15,519)	
CANAM OIL	Toronto	Re-refiner	• Oily Water • Waste Oils • Organic Solvents	619,645 (32,630)	
AIMCO SOLREC	Toronto	Reclaimer	• Organic Solvents	16,450 (31,025)	
SURPASS CHEMICAL	Toronto	Reclaimer	• Acids	(37,600)	No Waybill activity between April 1, 1981 and March 31, 1982
MINERAL RECOVERY	Toronto	Reclaimer	• Other Organic	(86,408)	No Waybill Activity between April 1, 1981 and March 31, 1982

1. Source: Ministry of the Environment - Waybill Records August 1st, 1980 to July 31st, 1981 and April 1st, 1981 to March 31st, 1982.

APPENDIX C (CONTINUED)

LICENSED RECEIVERS OF LIQUID INDUSTRIAL WASTE IN ONTARIO[1]

NAME	LOCATION	FACILITY TYPE/CAPACITY	TYPE OF WASTE RECEIVED MINISTRY OF THE ENVIRONMENT WASTE CLASSIFICATION	QUANTITY OF WASTE RECEIVED APRIL 1/81 TO MAR. 31/82 (Aug.1/80 TO JULY 31/81) (IMPERIAL GALLONS)	COMMENTS
BRITISH PETROLEUM REFINERY	Oakville	Reclaimer	• Oily Water	151,200 (219,950)	
FORD MOTOR COMPANY	Oakville	Reclaimer	• Oily Water	(34,200)	No Waybill activity between April 1, 1981 and March 31, 1982
FORD MOTOR COMPANY	Windsor	Reclaimer	• Oily Water	(8,200)	See Above
MOTOR CITY PETROLEUM	Windsor	Reclaimer	• Oily Water • Waste Oils • Organic Solvents	141,490 (75,930)	
GORMLEY SAND AND GRAVEL	Gormley	Reuser	• Oily Water • Waste Oils • Chlorinated Solvents	275,486 (274,831)	• Oils used mainly for dust control - road application
CEDARHURST QUARRIES	Mount Albert	Reuser	• Oily Water • Plant and Animal Wastes	2,700 (2,700)	
CANAM OIL	Breslau	Re-refiner Reclaimer	• Other Inorganic • Oily Water • Waste Oils • Organic Solvents • Chlorinated Solvents • Pigments, Paints, Printing and Adhesives • Plant and Animal Wastes	618,954 (1,639,485)	
BRESLUBE	Breslau	Reclaimer Re-refiner	• Acids • Alkalis • Metal Finishing Wastes • Oily Water • Waste Oils	664,248 (648,635)	
RIO ALGOM	Elliott Lake	Reuser	• Acids	320,000 (285,000)	Used in mineral recovery
STELCO	Hamilton	Reuser	• Acids	15,764 (22,353)	

1. Source: Ministry of the Environment - Waybill Records August 1st, 1980 to July 31st, 1981 and April 1st, 1981 to March 31st, 1982.

APPENDIX C (CONTINUED)

LICENSED RECEIVERS OF LIQUID INDUSTRIAL WASTE IN ONTARIO[1]

NAME	LOCATION	FACILITY TYPE/CAPACITY	TYPE OF WASTE RECEIVED MINISTRY OF THE ENVIRONMENT WASTE CLASSIFICATION	QUANTITY OF WASTE RECEIVED APRIL 1/81 TO MAR. 31/82 (AUG.1/81 TO JULY 31/81) (IMPERIAL GALLONS)	COMMENTS
SCANDEX	Kitchener	Reclaimer	• Acids • Alkalis • Metal Finishing Wastes • Phosphates • Other Inorganic • Oily Water • Waste Oils • Organic Solvents • Chlorinated Solvents	3,531,971 (2,395,864)	
VARNI COLOUR	Elmira	Reclaimer	• Metal Finishing Wastes • Organic Solvents • Chlorinated Solvents	32,753 (15,520)	
WOODINGTON SYSTEMS	Thorold	Reuser	• Oily Water • Waste Oils	187,253 (412,330)	
AGNEW LAKE MINES	Espanola	Reuser	• Acids • Oily Water	468,000 (468,000)	Used in mineral recovery
CANFLOW SERVICES	Sarnia	Reclaimer	• Oily Water • Waste Oils	200	
ENTROPEX CORP.	Sarnia	Reclaimer	• Oily Water • Waste Oils	39,699	
RETEK RESOURCE RECOVERY	Brantford	Reclaimer		245,290	
TOTAL RECLAIMERS/REUSERS				7,684,414 (6,908,720)	

1. Source: Ministry of the Environment - Waybill Records August 1st, 1980 to July 31st, 1981, and April 1st, 1981 to March 31st, 1982.

APPENDIX C (CONTINUED)

LICENSED RECEIVERS OF LIQUID INDUSTRIAL WASTE[1]

NAME	LOCATION	FACILITY TYPE/CAPACITY	TYPE OF WASTE RECEIVED MINISTRY OF THE ENVIRONMENT WASTE CLASSIFICATION	QUANTITY OF WASTE RECEIVED APRIL 1/81 TO MAR. 31/82 (AUG.1/81 TO JULY 31/81) (IMPERIAL GALLONS)	COMMENTS
TRICIL	Mercier, Quebec	Incinerator, Landfill	• Organic Solvents • Pigments, Paints, Printing and Adhesives	83,075 (110,806)	
SERVICE CENTRAL De RESERVOIRS	Montreal Quebec	Reclaimers	• Organic Solvents • Pigments, Paints, Printing and Adhesives	35,534 (53,260)	
KINETIC CONTAMINANTS	Niska, Alberta	Storage	• PCB's	5,295 (1,750)	
SCA	Model City New York	Physical Chemical Treatment	• Acids • Organic Solvents	83,088 (4,000)	
NORLITE	Cohoes New York	Reuser	• Organic Solvents • Other Organic	146,700 (16,300)	Burn solvents
FRONTIER CHEMICAL	Niagara Falls New York	Physical Chemical Treatment	• Acids, • Oily Water • Alkalis • Water Oils • Metal Finishing Wastes • Cyanides • Organic Solvents • Phosphates • Chlorinated Solvents • Other Inorganic • Other Organic • Pigments, Paints, Printing and Adhesives • Pesticides • Detergents, Cleaners and Soaps • Inert Sludges	2,348,121 (3,311,372)	
FRONTENAC	Niagara Falls New York	Transfer Station	• Acids • Waste Oils • Cyanides • Other Inorganic • Pigments, Paints, Printing and adhesives	84,793 (516,495)	

1. Source: Ministry of the Environment - Waybill Records August 1st, 1980 to July 31st, 1981, and April 1st, 1981 to March 31st, 1982.

APPENDIX C (CONTINUED)

LICENSED RECEIVERS OF LIQUID INDUSTRIAL WASTE[1]

NAME	LOCATION	FACILITY TYPE/CAPACITY	TYPE OF WASTE RECEIVED MINISTRY OF THE ENVIRONMENT WASTE CLASSIFICATION	QUANTITY OF WASTE RECEIVED APRIL 1/81 TO MAR. 31.82 (AUG.1/81 TO JULY 31/81) (IMPERIAL GALLONS)	COMMENTS
CECOS	Niagara Falls New York	Landfill, Physical Chemical Treatment	• Acids • Pigments, Paints, Printing, and Adhesives	17,815 (10,160)	
TONAWANDA TANK TRANSPORT	Buffalo New York			270	
INDUSTRIAL ENVIRONMENTAL SERVICES	Mount Marion New York			16,500	
LIQUID DISPOSAL	Utica Michigan	Incinerator	• Acids • Oily Water • Pigments, Paints, Printing and Adhesives	17,400 (77,700)	
GENERAL OIL	Redford Michigan	Reclaimer	• Waste Oils	25,600 (28,566)	
EMCO CHEMICAL	Detroit Michigan	Reclaimer	• Waste Oils	(2,500)	• No Waybill activity between April 1/81 and March 31/82
CHEM-MET SERVICES	Wyandotte Michigan	Physical Chemical Treatment	• Acids • Alkalis • Other Inorganic • Other Organic • Pigments, Paints, Printing and Adhesives	775,255 (345,242)	
NELSON INDUSTRIAL	Detroit Michigan	Physical Chemical Treatment	• Acids • Alkalis • Metal Finishing Wastes • Oily Water • Detergents, Cleaners & Soaps	399,696 (62,805)	
CARTER'S WASTE OIL	Detroit Michigan	Reclaimer	• Oily Water • Waste Oils	386,150 (195,450)	
ENVIRONMENTAL WASTE CONTROL	Inkster Michigan	Reclaimer	• Organic Solvents • Chlorinated Solvents	25,000	
EDWARDS OIL	Detroit Michigan	Reclaimer	• Oily Water • Waste Oil	206,949	
CANAM OIL	Fremont Ohio	Reclaimer	• Other Inorganic	(18,109)	Now Chemical Waste Management

1. Source: Ministry of the Environment - Waybill Records August 1st, 1980 to July 31st, 1981, and April 1st, 1981 to March 31st, 1982.

APPENDIX C (CONTINUED)

LICENSED RECEIVERS OF LIQUID INDUSTRIAL WASTE IN ONTARIO[1]

NAME	LOCATION	FACILITY TYPE/CAPACITY	TYPE OF WASTE RECEIVED MINISTRY OF THE ENVIRONMENT WASTE CLASSIFICATION	QUANTITY OF WASTE RECEIVED APRIL 1/81 TO MAR. 31.82 (AUG.1/81 TO JULY 31/81) (IMPERIAL GALLONS)	COMMENTS
ERIE POLLUTION CONTROL	Bedford Ohio	Physical/Chemical	• Acids	(74,800)	• No Waybill activity between April 1/81 and March 31/82
CHEMICAL WASTE MANAGEMENT	Vickery Ohio	Reclaimer	• Oily Water • Waste Oils	82,000	Formerly Canam Oil
WISEMAN OIL	Coruapolis Pennsylvania	Reclaimer	• Acids • Waste Oils • Organic Solvents	270,740 (82,780)	
C&M CHEMICAL	Pittsburgh Pennsylvania	Reclaimer	• Waste Oils • Organic Solvents	22,200	
TOTAL OUT OF PROVINCE RECEIVERS				5,232,281 (4,912,095)	

1. Source: Ministry of the Environment - Waybill Records August 1st, 1980 to July 31st, 1981, and April 1st, 1981 to March 31st, 1982.

APPENDIX D

PHASE ONE STUDY REPORTS

		Number of Pages
1.	Waste Quantities Study Proctor & Redfern Limited Weston Designers-Consultants Ontario Research Foundation	120
2.	Generic Process Technologies Study Proctor & Redfern Limited Weston Designers-Consultants	335
3.	Primary Environmental Information, Part 1, Geological/Hydrogeological Inventory Gartner Lee Associates Limited	20
4.	Primary Environmental Information, Part 2, Surface Water Inventory Gartner Lee Associates Limited Gore & Storrie Limited	28
5.	Primary Environmental Information, Part 3, Archaeological Resources Gartner Lee Associates Limited Museum of Indian Archaeology (London)	95
6.	Primary Environmental Information, Part 4, Climatology - Volume 1 (text) Gartner Lee Associates Limited Ontario Research Foundation	41
7.	Primary Environmental Information, Part 4, Climatology - Volume 2 (appendix) Gartner Lee Associates Limited Ontario Research Foundation	65

APPENDIX D (CONTINUED)

PHASE ONE STUDY REPORTS

		Number of Pages
8.	Primary Environmental Information, Part 5, Data Base Environmentally Sensitive Areas Gartner Lee Associates Limited	15
9.	Primary Information (Engineering Infrastructure, Transportation, Land Use) Proctor & Redfern Limited	35
10.	Background Paper on Waste Reduction Proctor & Redfern Limited Ontario Research Foundation	43

For a copy of these studies, please contact the following, indicating which study reports are required:

Michael Scott,
Director of Communications,
Ontario Waste Management Corporation
60 Bloor Street West, Suite 707
Toronto, Ontario M4W 3B8
1-800-268-1179 (Toll Free)

APPENDIX E

The Phase One Study Reports listed in Appendix D will be placed on deposit in the following locations:

A) Government Libraries

1. Ministry of the Environment,
   Departmental Library,
   135 St. Clair Avenue West,
   Toronto, Ontario
   M4V 1P5

2. Environment Canada,
   Department Library,
   Place Vincent Massey,
   Hull, Quebec
   K1A 1C7

B) Ontario University Libraries

1. Brock University,
   University Library,
   St. Catharines, Ontario
   L2S 3A1

2. Carleton University,
   University Library,
   Ottawa, Ontario
   K1S 5B6

3. University of Guelph,
   University Library,
   Guelph, Ontario
   N1G 2W1

4. Lakehead University,
   University Library,
   Thunder Bay, Ontario
   P7B 5E1

5. Laurentian University of Sudbury,
   University Library,
   Sudbury, Ontario
   P3E 2C6

6. McMaster University,
   University Library,
   Hamilton, Ontario
   L8S 4L8

7. University of Ottawa,
University Library,
Ottawa, Ontario
K1N 6N5

8. Queen's University,
University Library,
Kingston, Ontario
K7L 3N6

9. University of Toronto,
University Library,
Toronto, Ontario
M5J 2H7

10. Trent University,
University Library,
Peterborough, Ontario
K9J 7B8

11. University of Waterloo,
University Library,
Waterloo, Ontario
N2L 3G1

12. University of Western Ontario,
University Library,
London, Ontario
N6A 3K7

13. Wilfrid Laurier University,
University Library,
Waterloo, Ontario
N2L 3C5

14. University of Windsor,
University Library,
Windsor, Ontario
N9B 3P4

15. York University,
University Library,
Downsview, Ontario
M3J 1P3

C) Regional Libraries

1. Algonquin Regional Library System,
29 Mary Street,
Parry Sound, Ontario
P2A 1E3

APPENDIX E (CONTINUED)

2. Central Ontario Regional Library System,
129 Church Street South,
Richmond Hill, Ontario
L4C 1W4

3. Chatham Library,
120 Queen Street,
Chatham, Ontario
N7M 2G6

4. Eastern Ontario Regional Library Systems,
200 Cooper Street, Suite 6,
Ottawa, Ontario
K2P 0G1

5. Georgian Bay Regional Library System,
30 Morrow Road,
Barrie, Ontario
L4N 3V8

6. Lake Erie Regional Library System,
380 Saskatoon Street,
London, Ontario
N5W 4R3

7. Lake Ontario Regional Library System,
88 Wright Crescent,
Kingston, Ontario
K7L 4T9

8. Metro Toronto Library Board,
789 Yonge Street,
Toronto, Ontario
M4W 2G8

9. Midwestern Regional Library System,
637 Victoria Street North,
Kitchener, Ontario
N2H 5G4

10. Niagara Regional Library System,
15 Lloyd Street,
St. Catharines, Ontario
L2S 2N7

11. North Central Regional Library System,
334 Regent Street South,
Sudbury, Ontario
P3C 4E2

APPENDIX E (CONTINUED)

12. Northeastern Regional Library System,
6 Al Wende Avenue,
Kirkland Lake, Ontario
P2N 3G9

13. Northwestern Regional Library System,
910 Victoria Avenue,
Thunder Bay, Ontario
P7C 1B4

14. Sarnia Library,
124 Christina Street South,
Sarnia, Ontario
N7T 2M6

15. South Central Regional Library System,
220 Dundurn Street South,
Hamilton, Ontario
L8P 4K7

16. Southwestern Regional Library System,
660 Ouellette Avenue,
Suite 216,
Windsor, Ontario
N9A 1C1

17. Waterloo Regional Library Headquarters,
Marsland Centre,
7th Floor, 20 Erb Street West,
Waterloo, Ontario
N2J 4G7